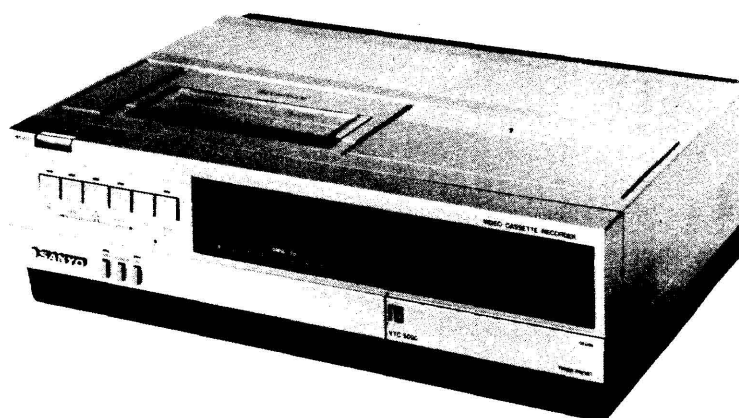


SERVICE MANUAL

COLOUR VIDEO CASSETTE RECORDER



VTC 5000



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Technical Data

General

Scanning Method	2 Head Helical Scanning
Tape Speed	18.73 mm/s
Rewind Time	< 6 min. with L-750 cassette
Loading Time	< 4 sec.
Timer	24 Hour or AM/PM 12 Hour Digital Display, 8-Days-One Program, EVERY DAY

Dimensions (WxHxD) 44 x 13.5 x 33cm

Video

Input Voltage	0.5 – 2.0 Vp-p
Input Impedance	75 ohm
Output Voltage	1 Vp-p
Output Impedance	75 ohm
Signal to Noise Ratio	≥ 42 dB
Colour Resolution	> 270 lines
B/W Resolution	> 300 lines

Audio

Input Voltage	–10 dB
Output Voltage	–5 dB
Output Impedance	High
Signal to Noise Ratio	≥ 40 dB
Frequency Response	50 Hz – 10,000 Hz

Tuner etc.

Destination	CTV system	Channel		RF Converter (Adjust Ch)	Power Source
		UHF	VHF		
EUROPE	PAL I. BG	21–68	2 – 4 5 – 12	30 – 39 (36)	220V 50Hz
EUROPE special cable TV	PAL BG	21–69	2 – 4, X, Y, Z S1, S2 S3-S19. 5 – 12	30 – 39 (36)	220V 50Hz
UK	PAL I	21–69	–	30 – 39 (36)	240V 50Hz
HONG KONG	PAL I	21–69	–	30 – 39 (36)	200V 50Hz
AUSTRALIA	PAL BG	21–65	0 – 5 5A-11	3 – 4	240V 50Hz
SOUTH AFRICA	PAL I	21–69	4 – 13	30 – 39 (36)	220/240V 50Hz
MALAYSIA	PAL BG	21–68	2 – 4 5 – 12	30 – 39 (36)	220V 50Hz
				3 – 4	
IRELAND	PAL I	21–69	A – C D – J	30 – 39 (36)	220V 50Hz
NEW ZEALAND	PAL BG	21–65	0 – 5 5A-11	2 – 3	240V 50Hz
INDONESIA	PAL BG	21 – 69	1 – 3 4 – 9	2 – 3 INDONESIA 3 – 4 EUROPE	110/220V 50Hz

I. INTRODUCTION

In comparison with the previous model, both the mechanism and circuits have been redesigned, and the following features have been realized:

1. Lighter weight

The efficient redesign of the mechanism, chassis, and circuits have achieved a total weight of only 8 kg. Also, the unit is now more compact because the width of the cabinet has been reduced from 480 mm to 440 mm.

2. Lower power consumption

Due to improvements in the tape transport system and a reduction in the power supply for the servo circuits from 12 V to 9 V by using power-saving ICs, the total power consumption is only 29 W, approximately 27% less than the 40 W of previous model.

3. Simplified mechanism operation using no solenoids

Three separate solenoids were used in previous model for engaging the pinch rollers, switching the reel drive, and cassette ejection. The loading motor in this model performs the mode switching done by the solenoids in the previous model, thus providing mechanism operation using no solenoids.

4. Four independent motors

This model uses four independent motors for the video heads, the capstans, the reels, and loading. This is one more than model (video head motor, capstan motor, and one motor for the reels and for loading).

5. New loading method

This model is different from previous models in that the tape is unloaded and returned to the cassette before rewind or fast forward is performed.

This reduces the load applied to the tape, thus reducing the possibility of tape damage and also extending the life of the heads.

6. Improved service ability

The reductions in the number of circuit boards, the number of mechanical parts, the amount of wiring, and the total number of parts, have greatly facilitated servicing of the VCR.

II. CIRCUIT DESCRIPTION

A. VIDEO CIRCUIT

The video system is composed of the following circuit boards:

- VP-1: recording amplifier, preamplifier (IC: LA7027)
- VD-1: luminance system
(ICs: LA7020, LA7025, LA7013 and LA7016)
Chrominance signal system
(ICs: M51437P, M51438P, M50180P and LA7016)

This video circuit is, for the most part, the same as the previous model in circuit composition and IC's used. However, since the picture for playback variations is black and white, ICM51439P has been omitted.

These block diagrams and signal flows are shown in Fig. 2-1-1 ~ Fig. 2-1-6.

1. Function of the VP-1 Circuit Board

This circuit includes a recording amplifier to supply the Y-FM signal and low-frequency converted chrominance signal to the video head and a preamplifier to amplify the extremely low level Y-FM signal and low-frequency converted chrominance signal, which are played back from the video head, to a fixed level.

The VP-1 also contains a drop-out compensator circuit. These are contained in a sealed case to eliminate interference from the outside.

The primary stage utilizes FET's and is equipped with the LA7027IC.

2. Function of the VD-1 Circuit Board.

This circuit contains a record/playback system for the luminance and colour signal. The luminance component of the input video signal is converted to an FM signal in the newly developed LA7020IC. The preemphasis, non-linear-emphasis, and W/D-clipper circuits are all included in the LA7020. Furthermore, besides a sync AGC the LA7020 also has a peak AGC so that you can record without overmodulation of a signal with a lot of shorts or signal shrinkage resulting from live broadcasts from the broadcast station. The playback system demodulates the FM signal to the original video signal by the new LA7025IC. The playback system also utilizes an LA7013 and an LA7019 which make up the y-comb filter noise canceler and the noise-bar reduction circuit for playback variations. The linear de-emphasis circuit, aperture correction circuit, clamping circuit, white clipper circuit, sync separator circuit, etc. are all contained in the LA7025, substantially reducing the number of parts contained in previous models.

These functions and signal flows are shown in Fig. 2-1-1 ~ Fig. 2-1-2.

a. APC-ID system

Until now, playback utilized both an AFC loop and an APC loop, but this model has only an APC loop to compensate for color phase jitter. Accordingly, the former VXO is not used. This speeds the response of the APC and greatly improves phase variation at the head switching point.

b. Synchronous detection ACC and ACK system

Synchronous detection type ACC and ACK are used. This makes for a low noise system.

c. Double APC system

The ACC loop and the APC loop each have one APC loop. This makes it so that there is no decrease in saturation in playback variations even if the pilot burst from soft tape is out of phase.

The former pilot burst insertion and cleaning circuits have been put into an IC, decreasing the number of parts.

The test signal generating circuit utilizes a ceramic resonator, and therefore, it is a stable unit not needing adjustment.

These block diagrams and signal flows are shown in Fig. 2-1-3 ~ Fig. 2-1-7.

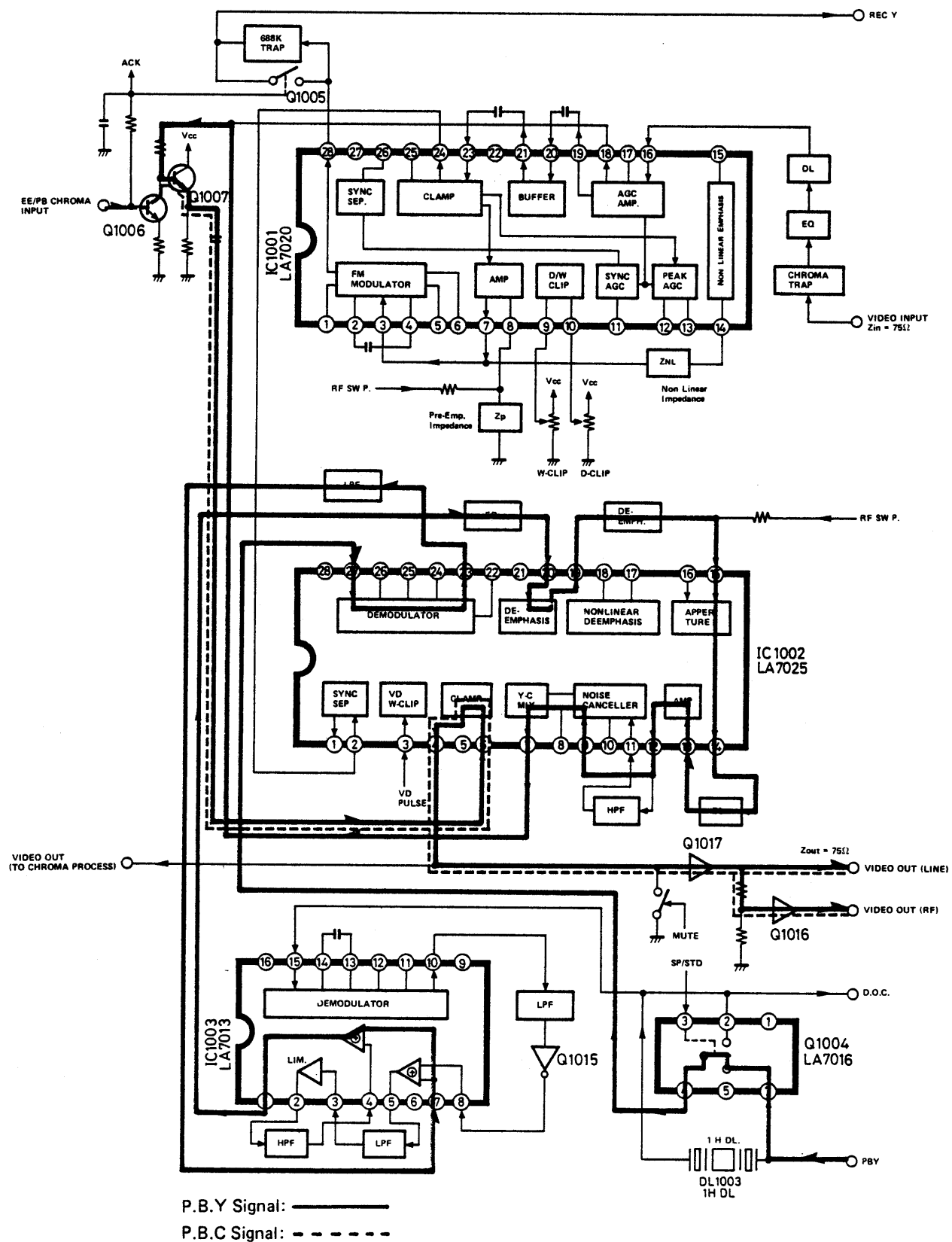
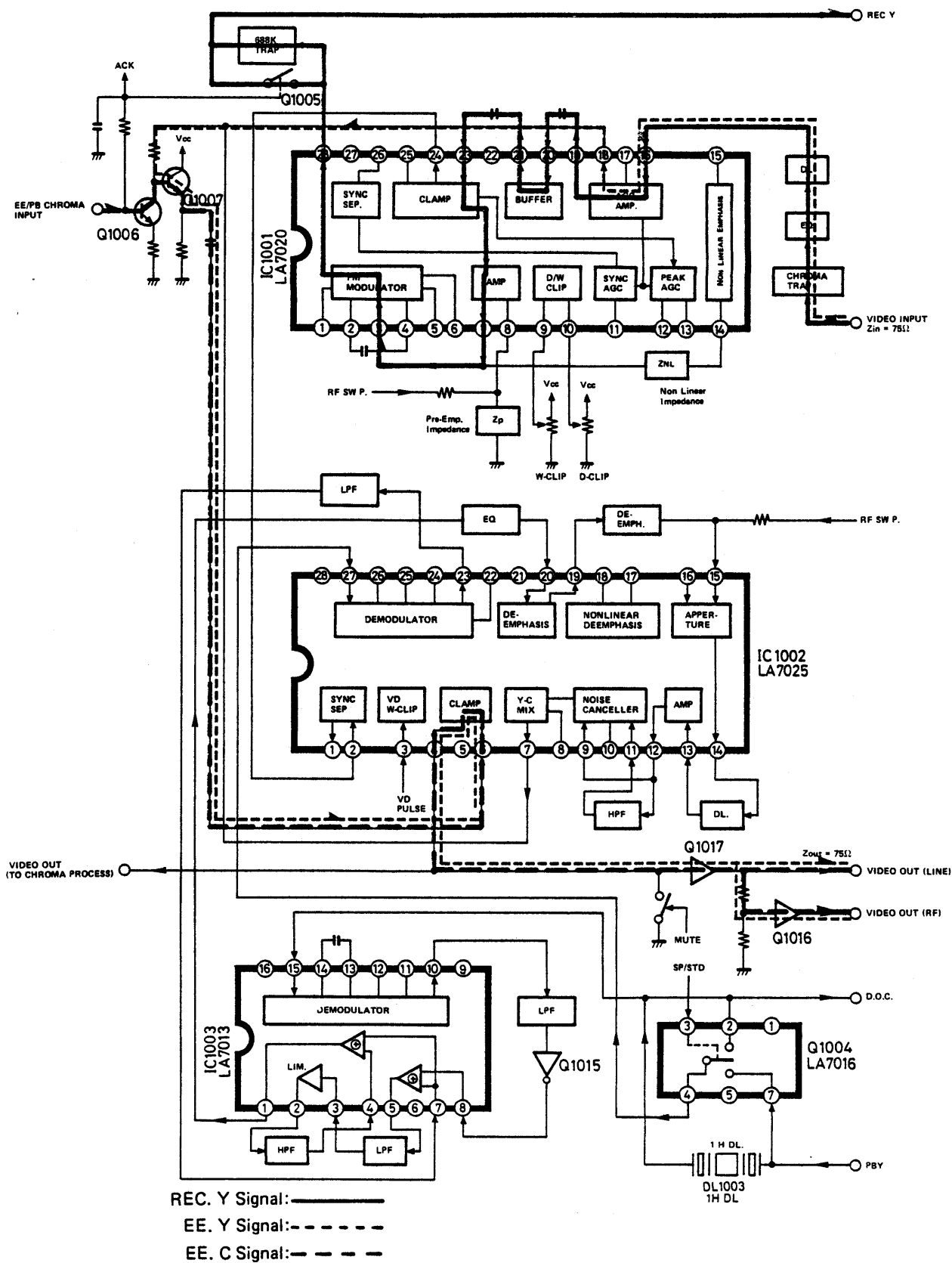


Fig. 2-1-1 Luminance process (VD-1, PLAY mode)



EE. CHROMA Signal: ———
 REC. CHROMA Signal: - - - - -

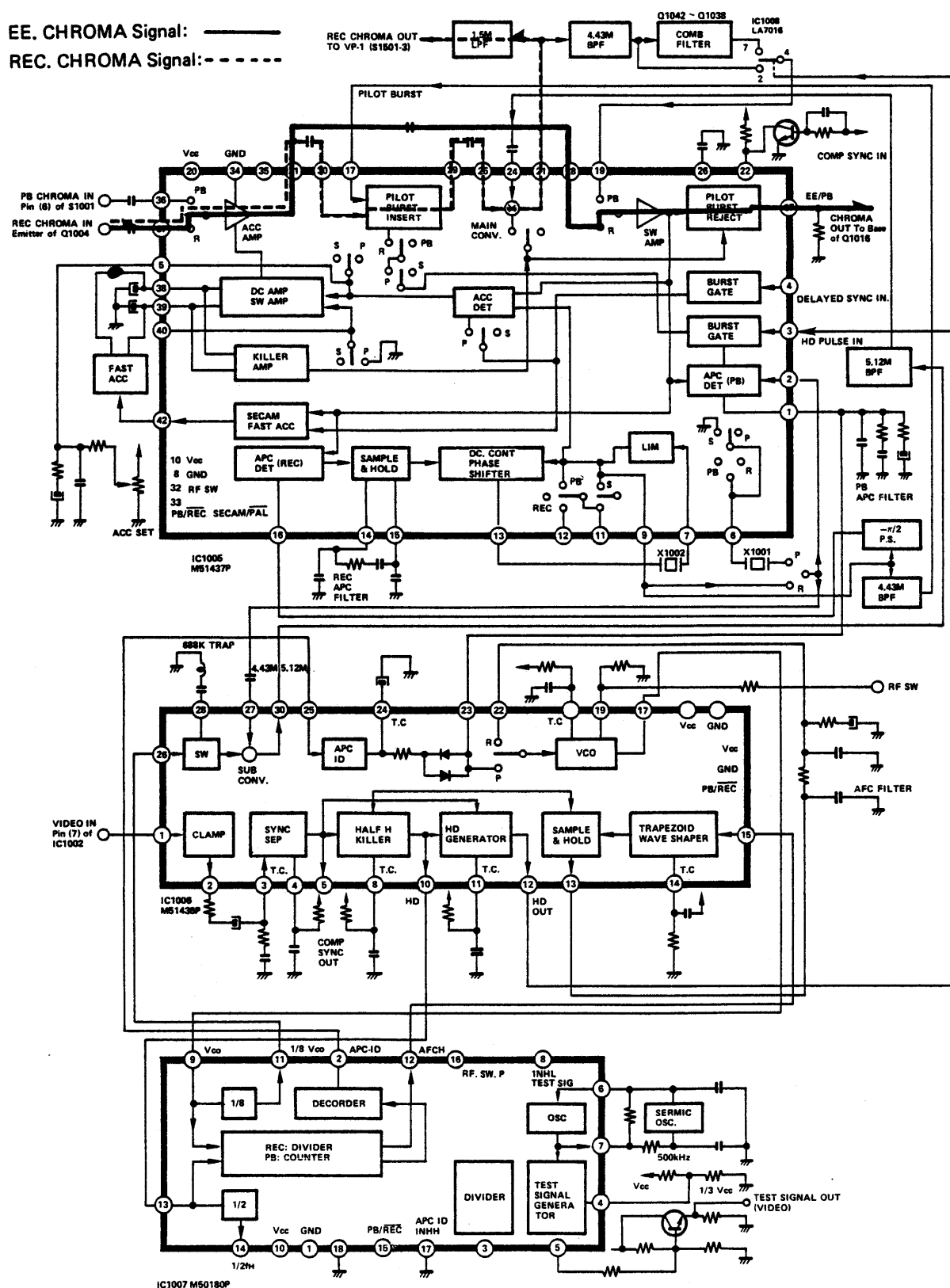


Fig. 2-1-4 Chroma system (VD-1, REC and EE mode)

A.C.C. Loop: —————
 A.P.C. Loop: - - - - -
 A.F.C. Loop: - - - - -

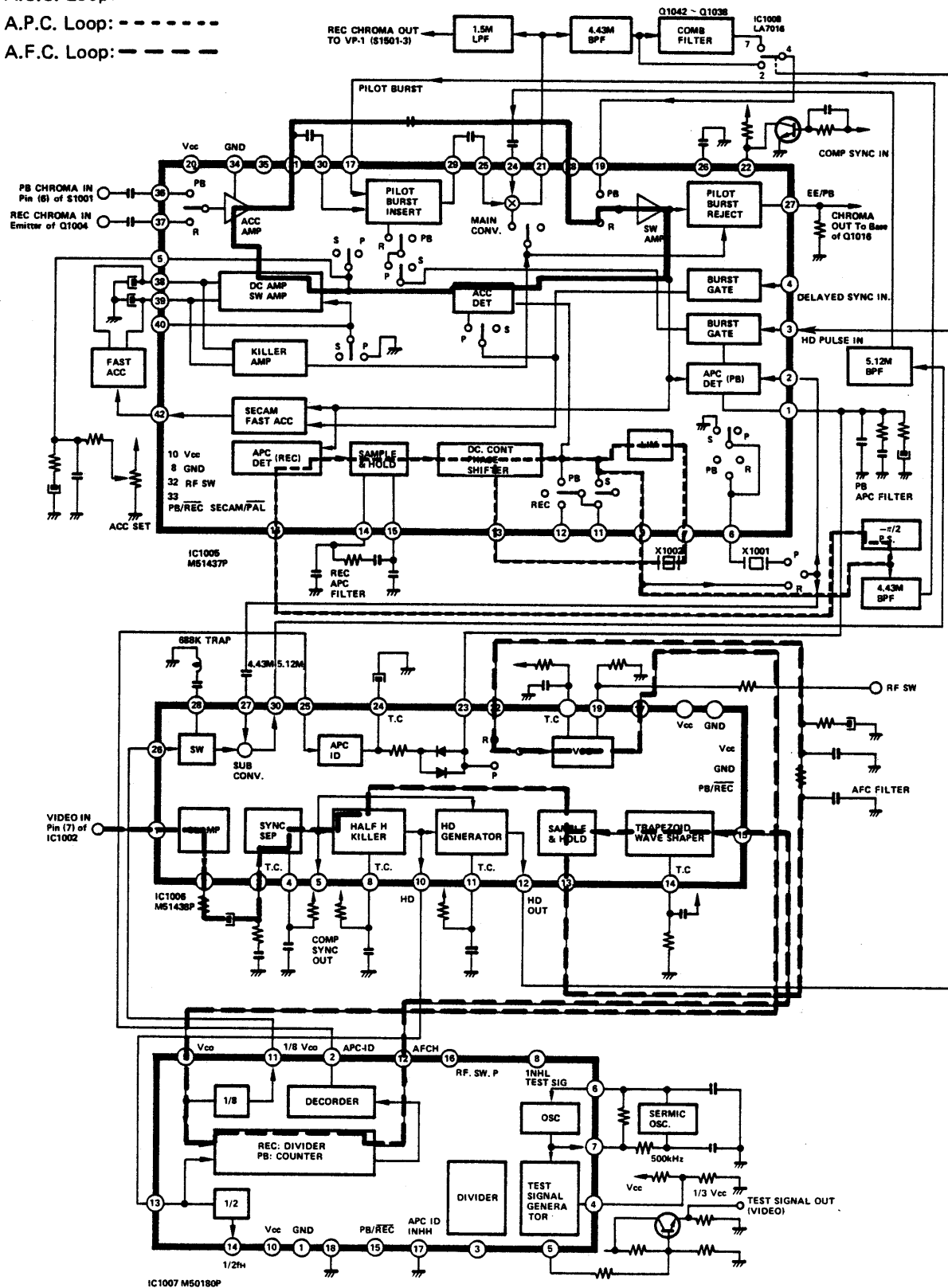
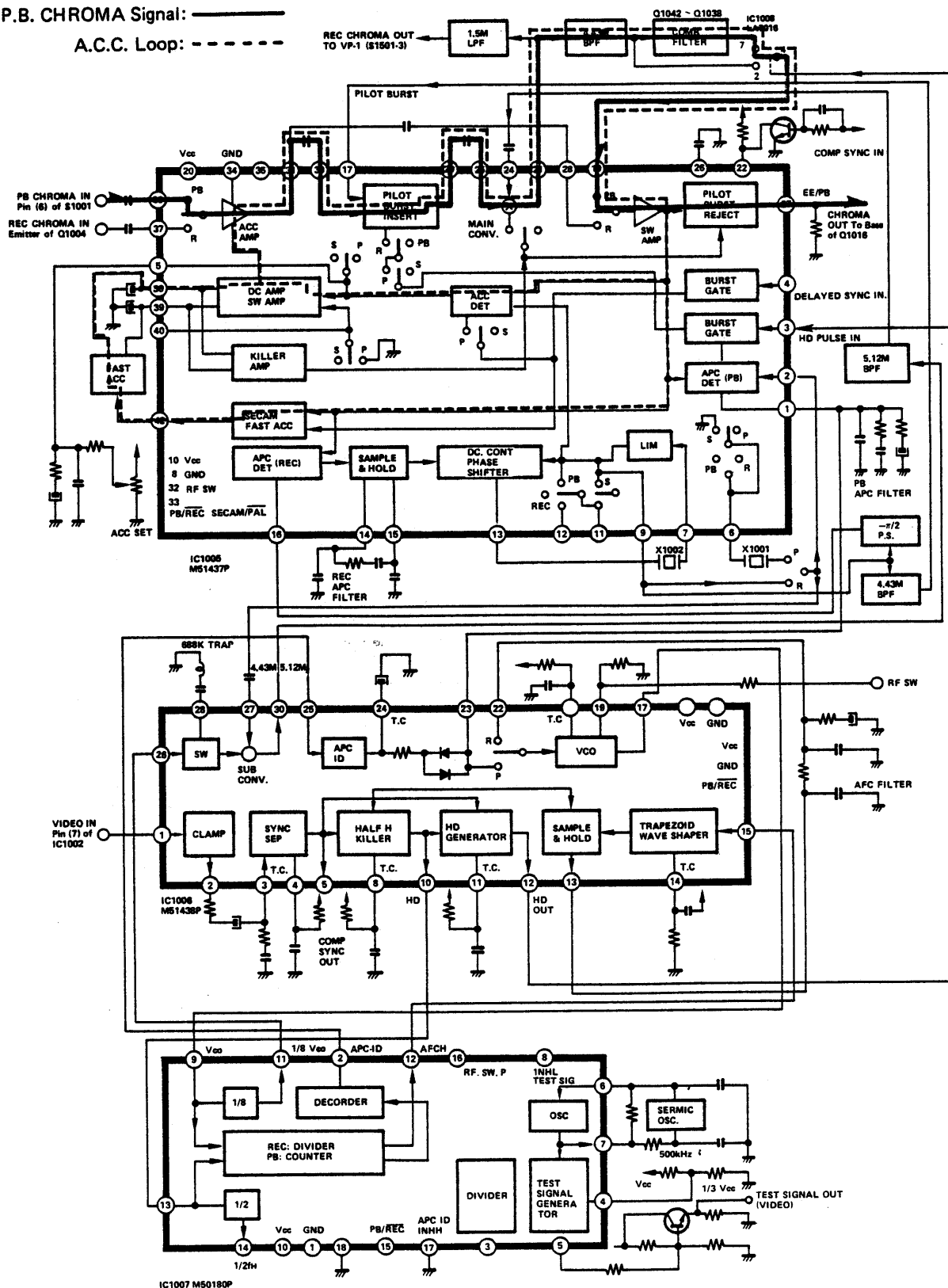


Fig. 2-1-5 Chroma system (VD-1, REC and EE mode)

P.B. CHROMA Signal: ———

A.C.C. Loop: - - - - -



A.P.C. Loop: ————
A.P.C-ID. Loop: - - - - -

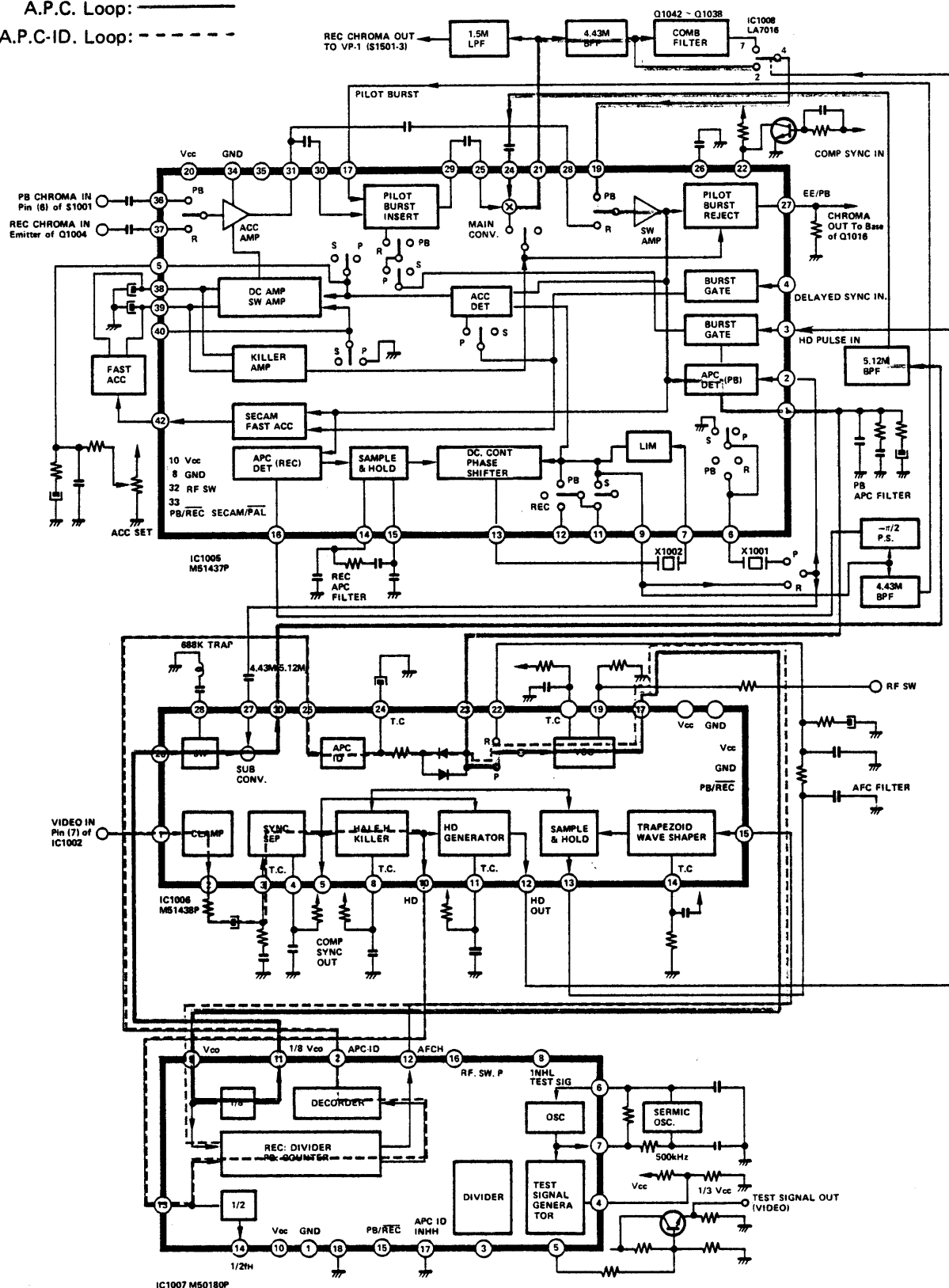


Fig. 2-1-7 Chroma system (VD-1, P.B mode)

B. SERVO CIRCUITS

1. Drum Servo Circuit

The drum servo circuit is mainly composed of IC4001 (BA848A) and IC4012, IC4013 (HA11713) of SY-1 circuit board. The drum motor drive circuit is provided inside the drum, conforming with previous models.

At the same time the drum motor is speed controlled by the PG signal (25Hz), the phases of the PG signal and the video vertical synchronization signal are compared during record and the revolution phase of the drum is fixed.

During playback the phase of the standard signal (50Hz) obtained from division of the 31.250 kHz frequency is compared and the revolution phase of the drum is fixed.

a. Controlling the speed of the drum motor

When a phase servo is used for a DC motor, a circuit that will increase the rpm of the motor up to the level of rpm applied to the phase servo is necessary. The speed control circuit performs this function for the drum motor.

This speed control circuit is mainly composed of IC4012 (HA11713).

The RF switching pulse input to pin (6) of IC4012 is amplified by FG amplifier 1 [pin (8) of IC4012], converted to a double frequency at the full-wave rectifier 1, and a double-cycle pulse with a width of approximately 20 μ s is generated by Schmitt 1 and PG3.

This PG3 output is delayed approximately 20 μ s at delay 1, and converted into a triangular wave at triangular wave generator 1 [pin (11) of IC4012]. The output from PG3 is also supplied as a gate pulse to sample hold 3.

Because the peak voltage of the triangular wave is detected at sample hold 3, the voltage just prior to the peak is gated or held (pin 12) according to the gate pulse, and, after the current is amplified, it is sent from pin (13) to pin (14) to serve as the speed control output.

If the rpm of the motor is low, the interval between the (+) PG pulse and the (–) PG pulse will be wide. Consequently, the RF switching pulse will become low frequency, the peak voltage of the triangular wave will become high, and the gate voltage and the voltage output to pin (13) will also become high.

Conversely, if the rpm of the motor is high, the interval between the (+) PG pulse and the (–) PG pulse will be narrow. Consequently, the RF switching pulse will become high frequency, the peak voltage of the triangular wave will become low, and the gate voltage and the voltage output to pin (13) will also become low.

When the voltage which is output to pin (13) becomes high, the drum motor drive circuit increases the rpm of the motor, and when this voltage becomes low, the motor drive circuit decreases the rpm of the motor. In this way, the rpm of the motor, i.e., the video head, can be determined according to the time constant [externally mounted circuit of pin (9) of IC4012] which serves to establish the angle of the triangular wave.

Starter 1 compares the output levels of triangular wave generator 1 and sample hold 3, and operates for the period during which sample hold 3 is lower.

The triangular wave is not generated when the motor stops, nor during the time the motor operates at low speed. Because the output of triangular wave generator 1 is high level, a high level starting voltage is output to pin (13).

After this, the triangular wave is generated, and starter 1 stops. However, because the peak voltage of the triangular wave becomes high during low and medium speed rotation, the starting voltage is output to pin (13), and the servo activates quickly.

The speed control output which is input to pin (14) is lowered to ground level when there is no need for the video head to revolve. It then passes through start stop 1, the circuit which serves to stop the revolution of the drum motor, and is input to the add 1 circuit.

At this add 1 circuit, the output is added to and matched with a phase control output, which will be described later, and this is supplied to the drum motor drive circuit which is built into the drum motor. Because the head revolution speed varies slightly in the picture search and other modes, switch 1, which is composed of transistors, is used to modify the time constant of triangular wave generator 1. Moreover, if the voltage of the phase-control output which enters pin (1) of the add 1 circuit also becomes high, the motor drive circuit is controlled so that the motor will revolve faster, and when the voltage becomes low the motor will revolve more slowly.

(Refer Fig. 2-2-1 and Fig. 2-2-2)

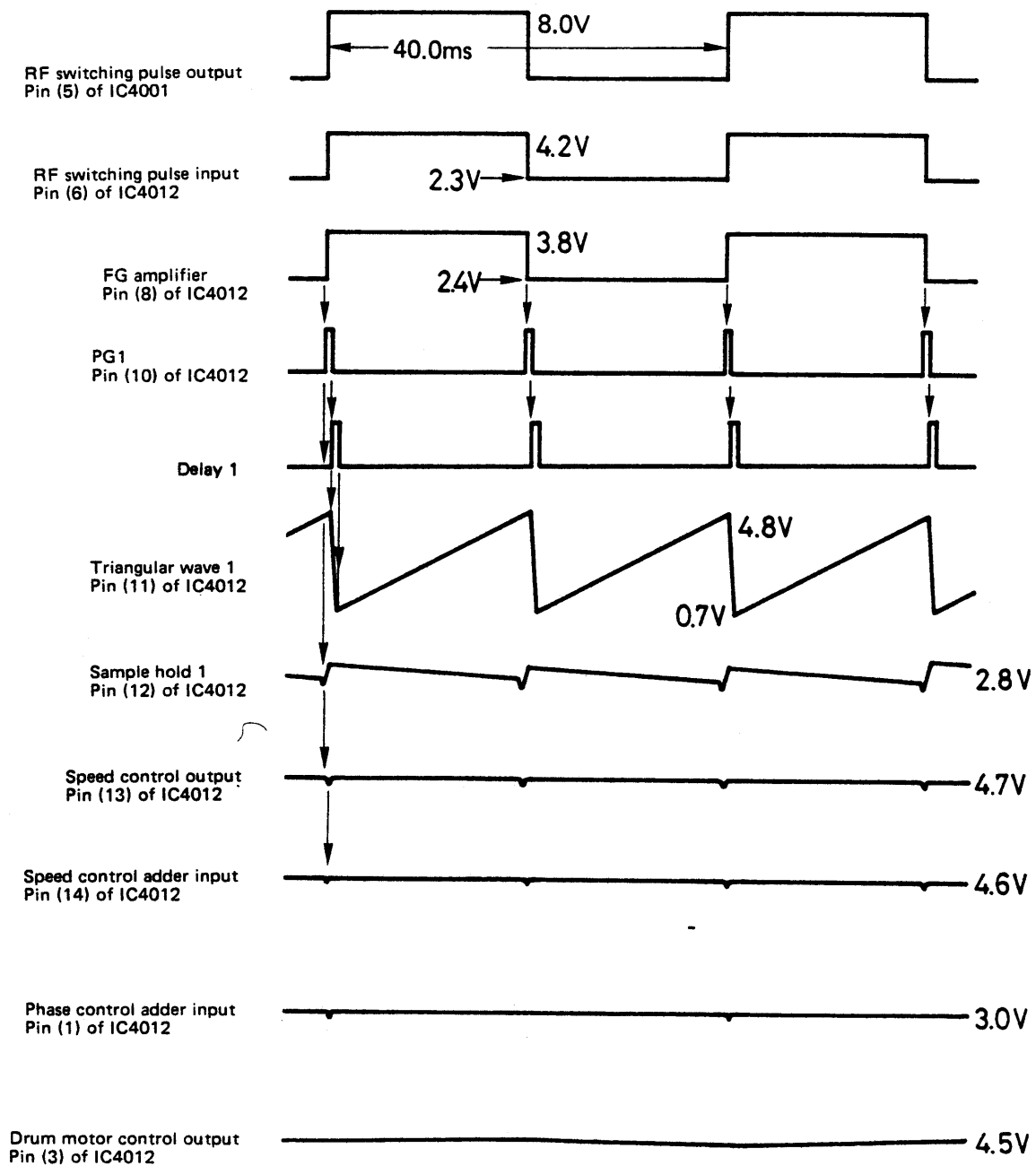


Fig. 2-2-1 Drum motor speed control time chart

b. Application of phase control to the drum motor

The phase control circuit of the drum motor is mainly composed of IC4001 (BA848A).

During recording, the revolution phase of the video head is synchronized with the video signal (the position at which the video head begins to write on the tape is 7H before the front edge of the vertical synchronization signal). During playback, this pattern recorded on the tape must be accurately traced by the head (which is the same head as that used for recording).

The time when the A head begins writing is recorded on the lower edge of the tape by the control (CTL) head.

Conversely, during playback this control signal is played back, and phase control is applied to the drum motor so as to start the A head tracing at this playback time. Actually, because a capstan servo system is used, the video head, during playback, revolves in synchronization with the reference signal produced by the quartz oscillator and frequency divider 1 circuits.

The playback control signal is supplied to the capstan servo circuit, and controls the tape speed so that the reference signal and the phase match. Consequently, with the reference signal acting as an intermediary, the revolution phase of the video head is synchronized with the playback control signal.

During record the vertical synchronization signal of the video signal from pin (13) of IC4001 and during playback the standard signal divided from the 31.250 kHz crystal and coming from pin (1) of IC4001 are input and each one is counted down 1/2 and then a signal corresponding to record or playback is selected by switch 1. The control of this switch becomes record when pin (16) is HIGH and playback when pin (16) is LOW.

Accordingly, the MM3 is triggered by the vertical synchronization signal of the video signal during record or by the 50Hz produced by the crystal during playback and then a gate pulse is prepared by PG1.

The signal displaying the revolution phase of the video head is input to pin (2), and after the switching position has been adjusted, the signal becomes a triangular wave by slope 1 at the same time it is output from pin (5) as an RF SW pulse.

The triangular wave obtained from the revolving of the head is gated by the gate pulse obtained from the vertical synchronization signal of the video signal, held at pin (8), current amplified, and then output from pin (9).

This voltage is input to pin (1) of IC4012 of the speed control circuit, passed through the voltage follower, added to the speed control output, and then sent to the drum motor drive circuit from pin (3).

When the motor revolves too slowly the triangular wave shifts to the upper right as seen on the timing chart, and so the gate voltage becomes HIGH, the voltage supplied to the drive circuit also becomes HIGH, and the motor revolves faster to bring the triangular wave back to the left and correct the phase.

When the motor revolves too fast, the opposite occurs. In other words, the video head revolves in synchronization with the video signal at a phase determined by the delay time of the MM3. This phase adjusts the position at which the video head begins to scan so that it is 7H before the front edge of the vertical synchronization signal.

(Refer, Fig. 2-2-3 and Fig. 2-2-4)

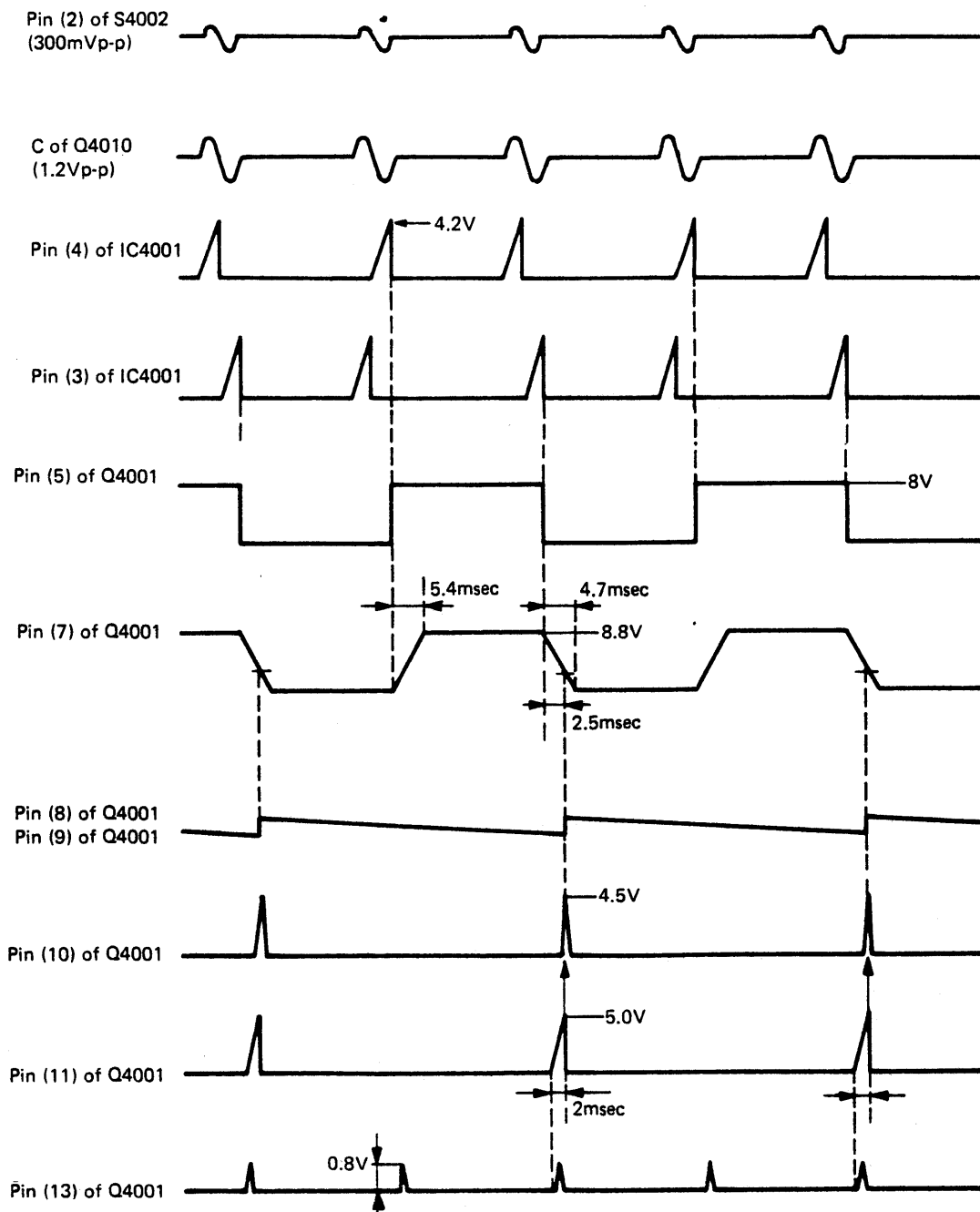


Fig. 2-2-3 Drum motor phase control timing chart

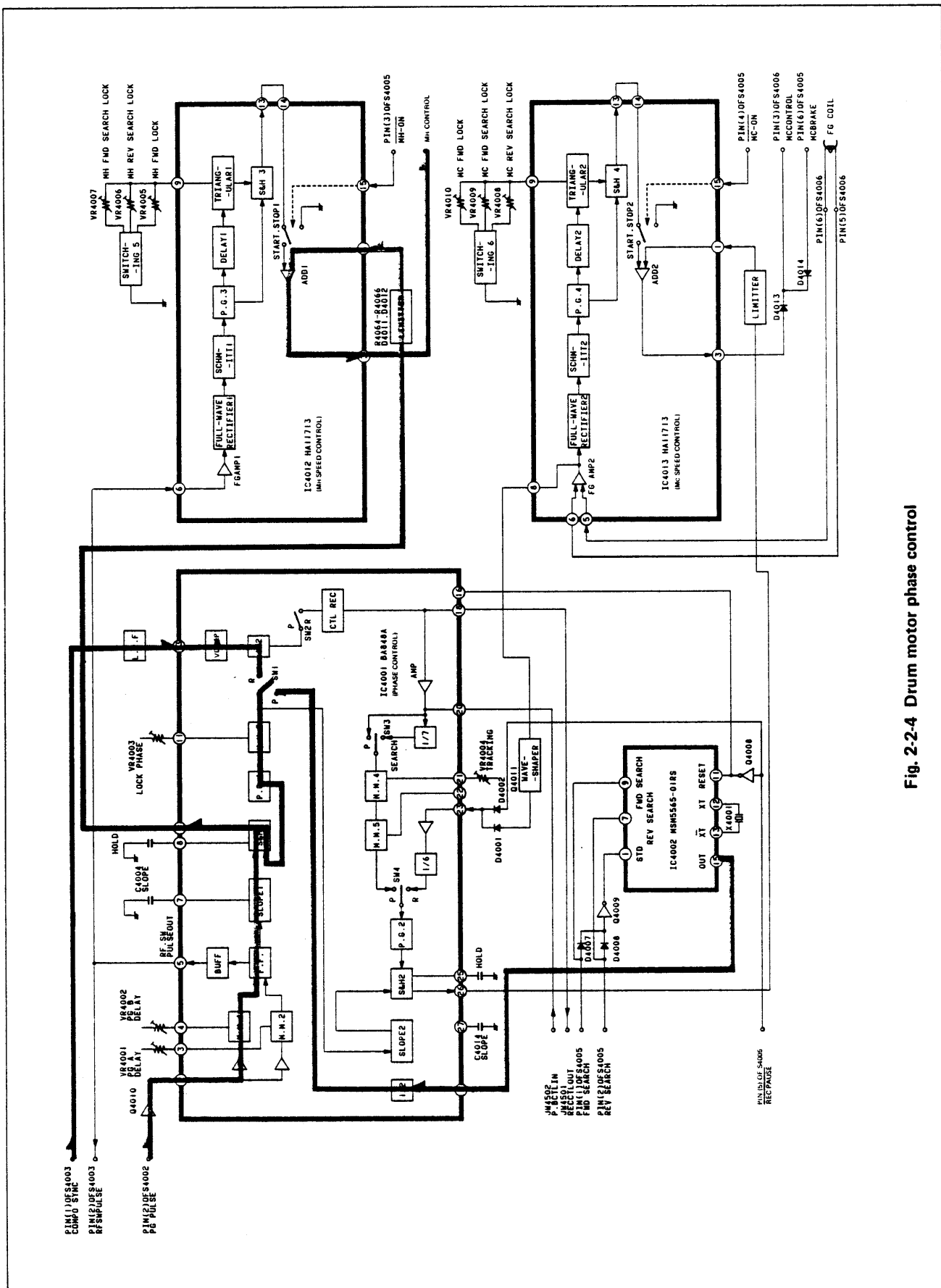


Fig. 2-2-4 Drum motor phase control

2. Capstan Servo Circuit

The capstan servo circuit is mainly composed of IC4001 (BA848A) and IC4012 (HA11713) and the capstan motor drive circuit is composed of SV-2 circuit board.

a. Application of speed control to the capstan motor

The speed control circuit of the capstan motor consists mainly of IC4013 (HA11713); it is primarily the same as the speed control circuit of the drum motor. After the FG pulse which is input to pin (6) of IC4013 is amplified at FG amplifier 2, [pin (8) of IC4013], its frequency is turned into a double frequency wave by full wave rectifier 2, and then causes a double cycle pulse with a $20\mu\text{s}$ width to be generated as Schmitt 2 and PG4.

This PG4 output is delayed approximately 20 microseconds by delay 2 and a triangular wave is produced by triangular wave generator 2 [pin (11) of IC4013]. The output of PG4 is also supplied to sample hold 4 as a gate pulse.

Because the peak voltage of the triangular wave is delayed at sample hold 4, the voltage just before peak voltage is gated or held [pin (12)] according to the gate pulse, and, after current amplification, is sent as speed control output from pin (13) to pin (14).

The speed control output which is input to pin (14) is added to the phase control output (described later), which is input to pin (1) by the add 2 circuit. Next, it is supplied from pin (3) to the capstan motor drive circuit which makes up the capstan motor.

Because the tape speed is different for PLAY, REC, and picture search, the time constant of triangular wave generator 2 is changed by using switch 2. (Refer Fig. 2-2-5 and Fig. 2-2-6).

b. Phase control of the Capstan Motor

During record it is not necessary to decide the revolution phase of the capstan motor, but if the phase control is applied, the motor revolution can be precisely controlled. The standard signal (25Hz) utilized in the drum motor control circuit is utilized as the standard signal for the capstan motor.

The FG pulse amplified at the IC4013 for speed control is formed at Q4011, input to pin (23) of IC4001, made 25Hz in the 1/6 counter, and forms the gate pulse at PG2.

A triangular wave is produced from the vertical synchronization signal in SLOPE 2. By gating this triangular wave using the gate pulse made from the capstan FG pulse, phase detection is performed, and it is then output from pin (26) as a phase error signal, input to pin (1) of IC4013 of the speed control circuit, passed through the voltage follower, added to the speed control output, and sent to the capstan motor drive circuit from pin (3).

During playback, the playback control pulse obtained from amplified by SV1-1 is amplified by AMP 1, passed through SW3, delayed for about one period by the subtracking MM4 and tracking MM5, passed through SW4, and a gate pulse is formed using PG2.

Because picture search is 7 times normal speed, the subtracking MM3 is triggered by the 25Hz control pulse counted down 1/7.

By applying phase control using this counted down control pulse, a clear picture with a stable noise band can be obtained. (Refer Fig. 2-2-7 and Fig. 2-2-8).

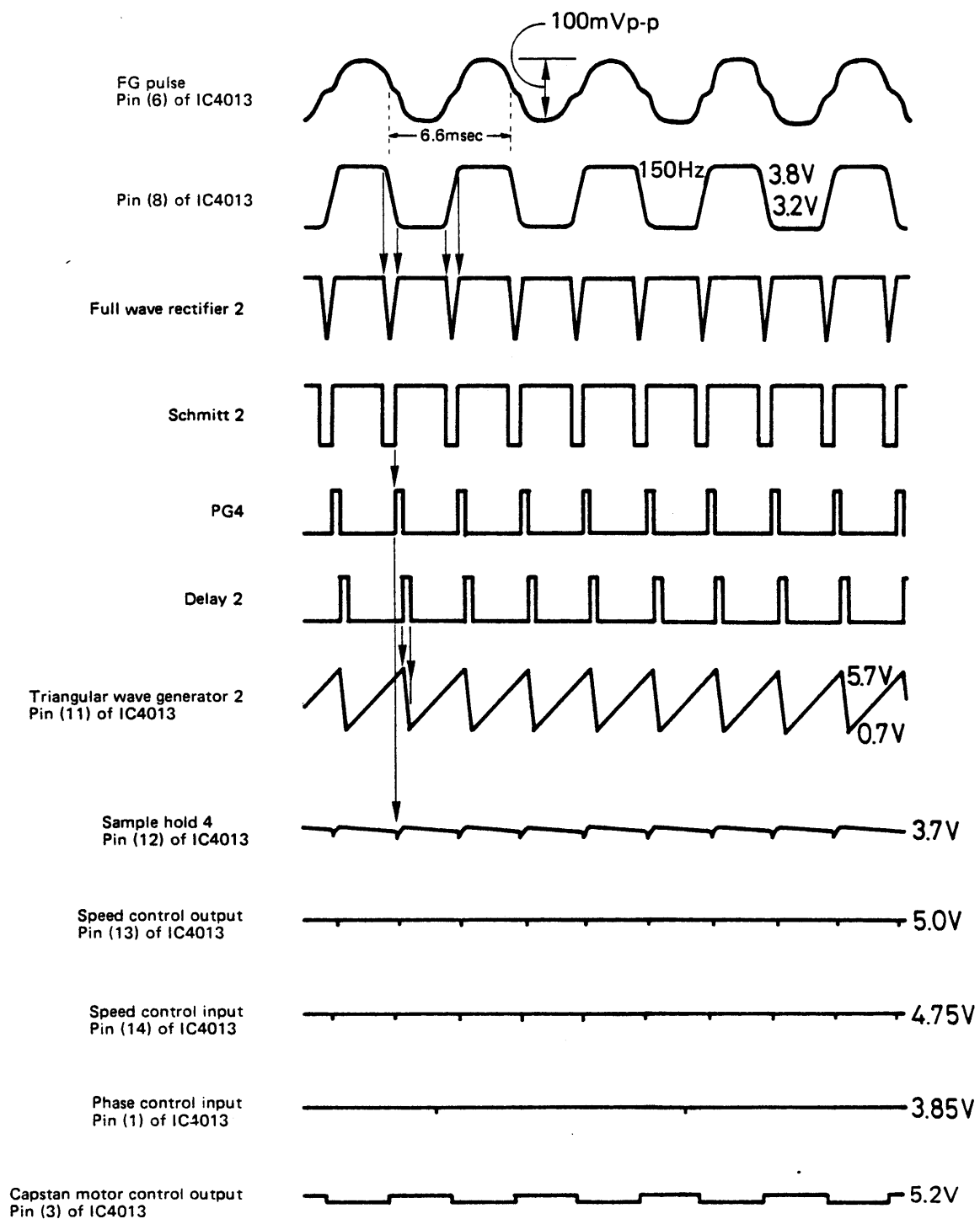


Fig. 2-2-5 Capstan motor speed control timing chart

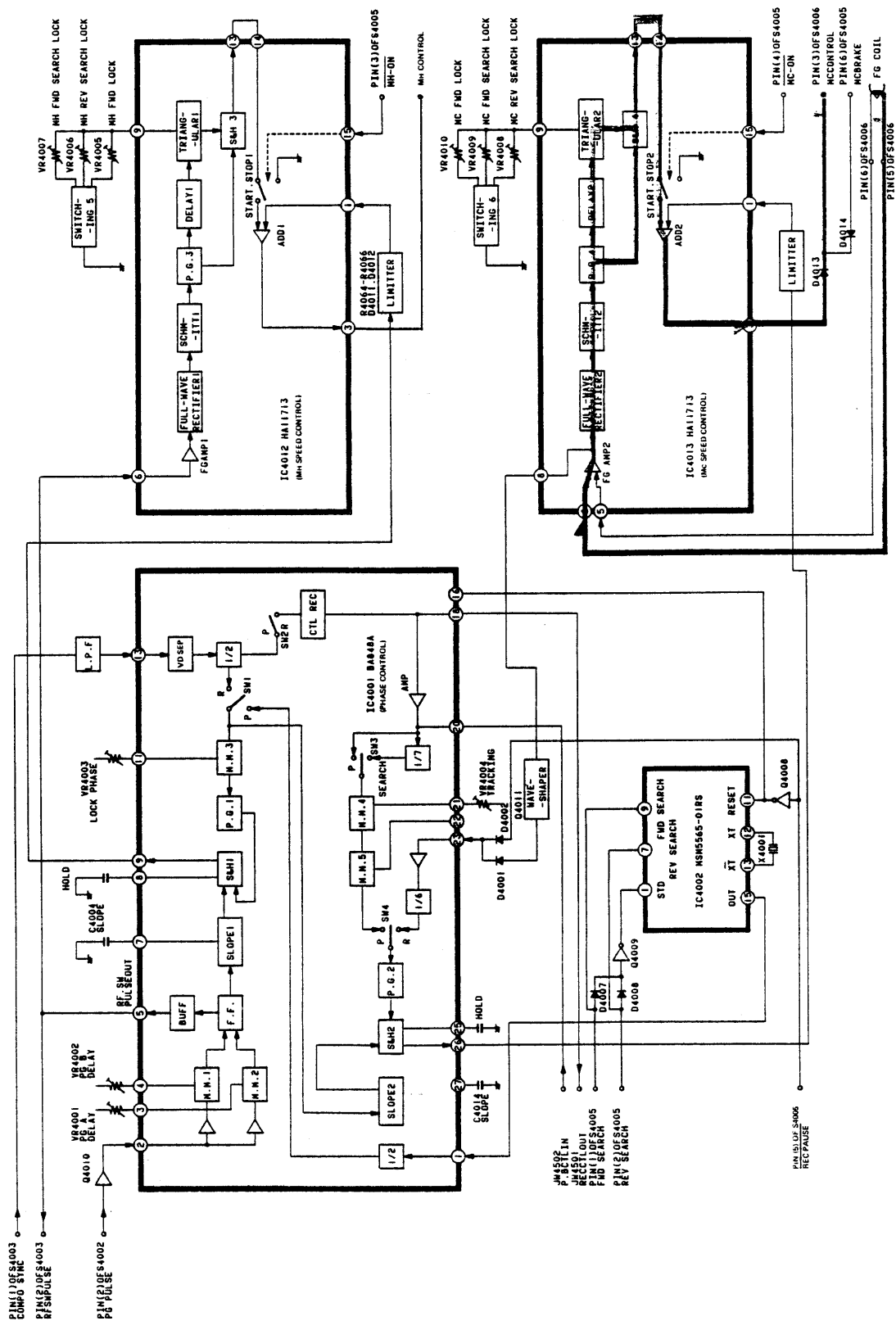


Fig. 2-2-6 Capstan motor speed control

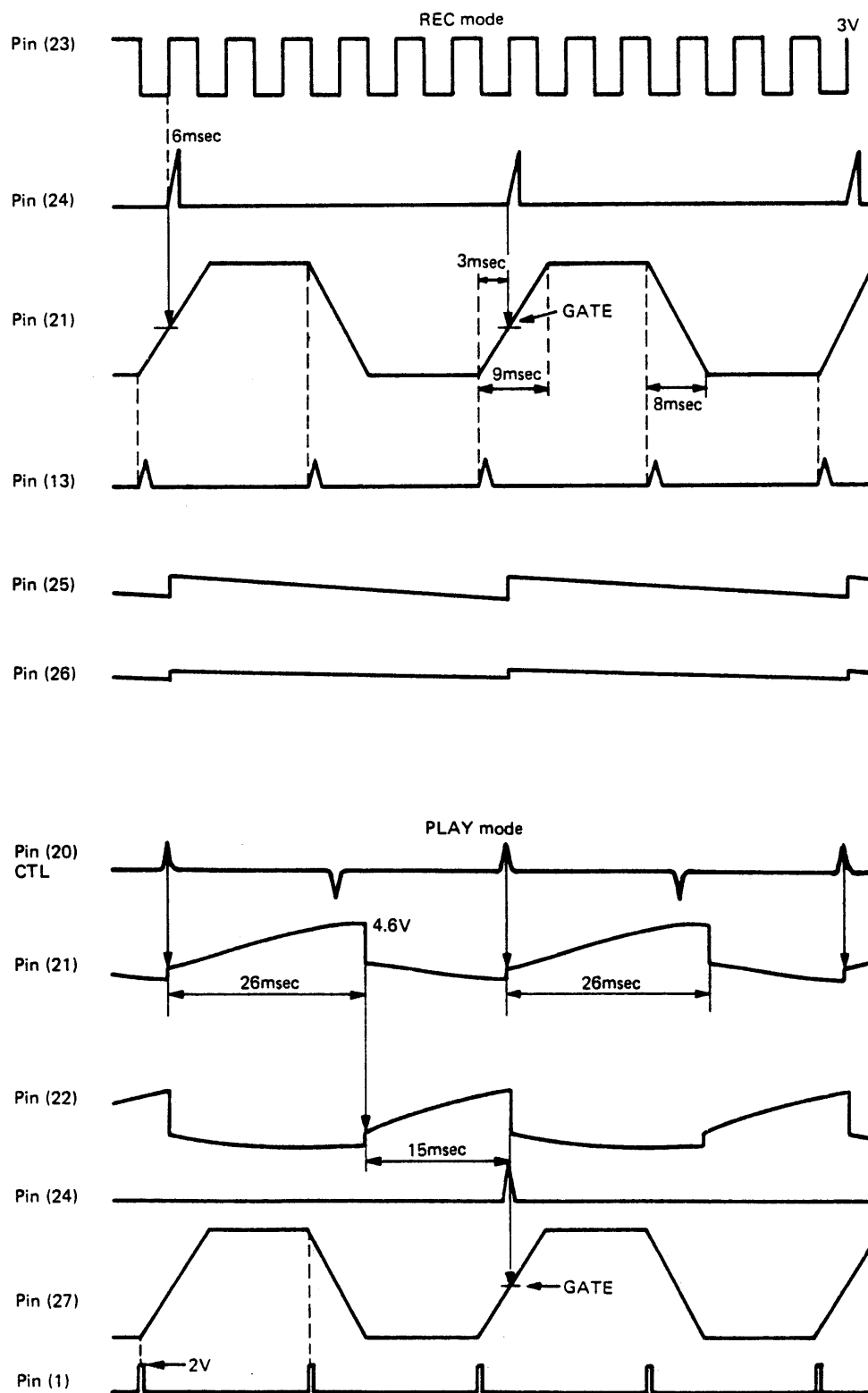


Fig. 2-2-7 Capstan motor phase control timing chart (IC4001: BA848A)

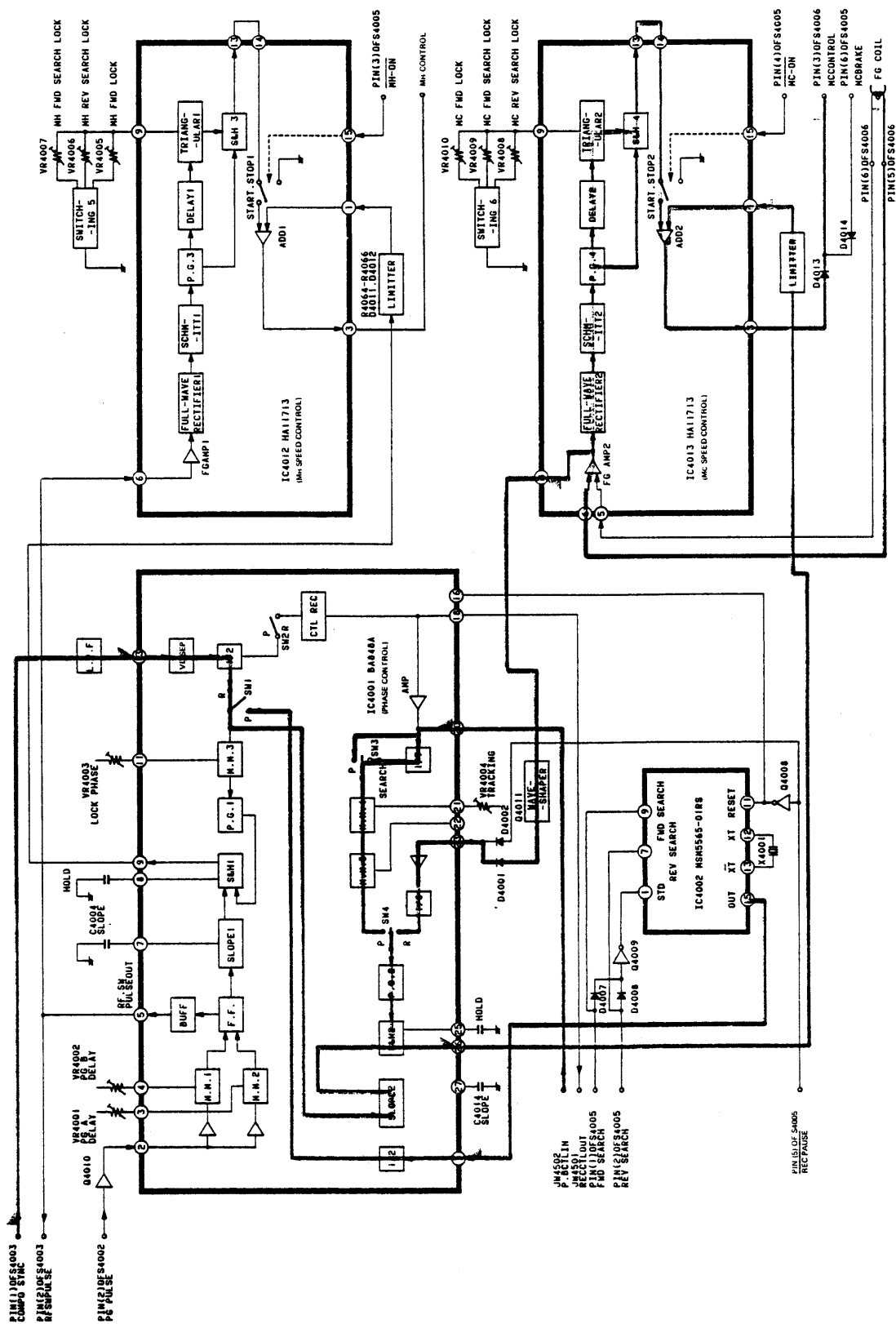


Fig. 2-2-8 Capstan motor phase control

3. Picture Search Circuit

The picture search circuit makes up part of the drum servo circuit and the capstan servo circuit. This circuit changes the revolution of the drum during picture search so that the horizontal frequency of the playback video signal becomes 15.625 kHz. It also changes the revolutions of the capstan so that the tape advance speed becomes 7 times normal speed.

a. Changing the number of revolutions of the drum during playback variations

In order for the tape speed to increase approximately 7 times during PICTURE SEARCH, the video heads trace over a number of tape patterns. In one tape pattern there is a signal of 312.5H signal recorded, but so that the relative speed of heads and tape is different during PICTURE SEARCH, a $[312.5 - (m - 1)]$ H signal is played back in one trace of the video heads.

"m" is a multiple of the normal tape speed, and it becomes minus (—) during REV SEARCH.

Thus, the horizontal sync frequency shifts, the television's horizontal sync goes out, and the image rolls on the screen during PICTURE SEARCH. Because of this, the number of revolutions of the video heads changes, getting rid of horizontal sync frequency shifts during PICTURE SEARCH.

At this time, vertical sync frequency shifts from the normal 50Hz. However, because the television's vertical sync range is generally wider than the horizontal frequency range, there is no problem in normal usage.

b. Video head tracking

The tape tracking situation of the video head during PICTURE SEARCH is shown in Fig. 2-2-9.

For high-speed FWD SEARCH, the tape is transported at 7 times normal tape speed in the same direction as tape movement during normal playback. Therefore, when video head A begins tracing from the start of track A1, it intersects tracks B1, A2 --- and B3, until it reaches the end of track A4. This corresponds to one field of a played back video signal. At this time, the playback head output obtained is only tracks A1, A2, A3 and A4, because video heads A and B each have the same azimuth angle.

Video head B for the next field starts tracing from the start of track B4, intersecting tracks A5, B5 --- and A7, finishing tracing at the end of track B7. As seen in the diagram for the head output at this time, noise position is in the same position in field A and field B.

When this is seen on a television screen, only 3 noise bars will appear, and 4 in REV SEARCH.

On reel drive systems, 6 noise bars will appear because tape speed cannot be accurately controlled.

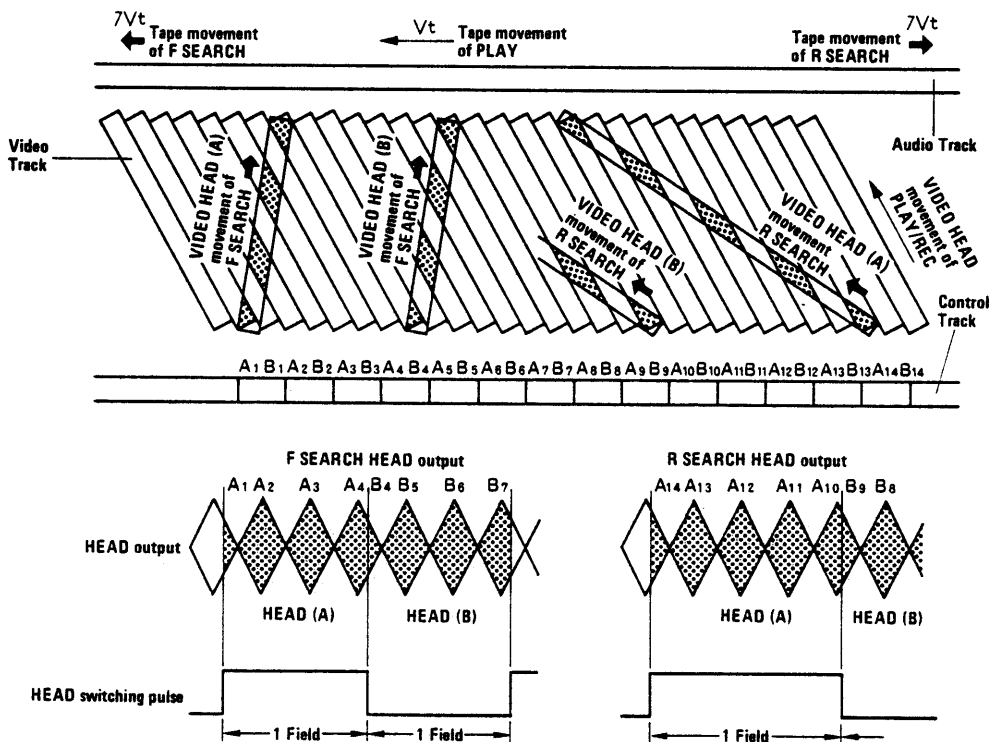


Fig. 2-2-9 Tape tracking situation

5. Reference signal generation circuit

During recording, the video head revolution phase must bear a relationship to the recording video signal and a certain uniform phase. Because of this, a vertical sync signal taken from the video signal is used as a base signal for the servo during recording.

The multiple sync signal transmitted from the video circuit board passes the low pass filter composed of R4009, C4009, R4010 and C4010, drops the horizontal sync signal, becoming only a vertical sync signal.

During playback, 31.250 kHz is oscillated by a crystal, and then 50 Hz is generated by frequency division of this. During normal playback, pin (1) of IC4002 becomes HIGH, and IC4002 divides the frequency by 1/625 at the IC having the counter and crystal oscillation circuit.

To change the number of revolutions of the drum during special playback, the signal is divided by 1/613 and 1/641, and is changed to HIGH, pin 5 to HIGH, and pin 6 to HIGH, for FWD SEARCH and REV SEARCH, respectively.

Because the drum locks on this signal and revolves during playback, in playback variations revolution is slower in REV SEARCH, and faster in FWD SEARCH, and compared to normal playback speed.

Changeover of the reference signal for record or playback is done by making pin (16) of IC4001 LOW or HIGH respectively, and is performed in IC4001.

6. SV1-1 control pulse record/playback circuit

The vertical synchronization signal supplied from pin (18) of IC4001 of SV1 PCB is amplified by Q4503 and supplied to the control head. The other terminal of the control head is connected to pin (2) of P4501 and earthed to Q4504 through C4501 and R4511.

During playback, Q4503 becomes ON, the record terminal of the control head is earthed, head output is obtained from pin (2) of P4501, and it is amplified and shaped by Q4505 and IC4501. It is then supplied to pin (20) of SV1 IC4501 by the open collector transistor Q4506 and used for tracking control during playback.

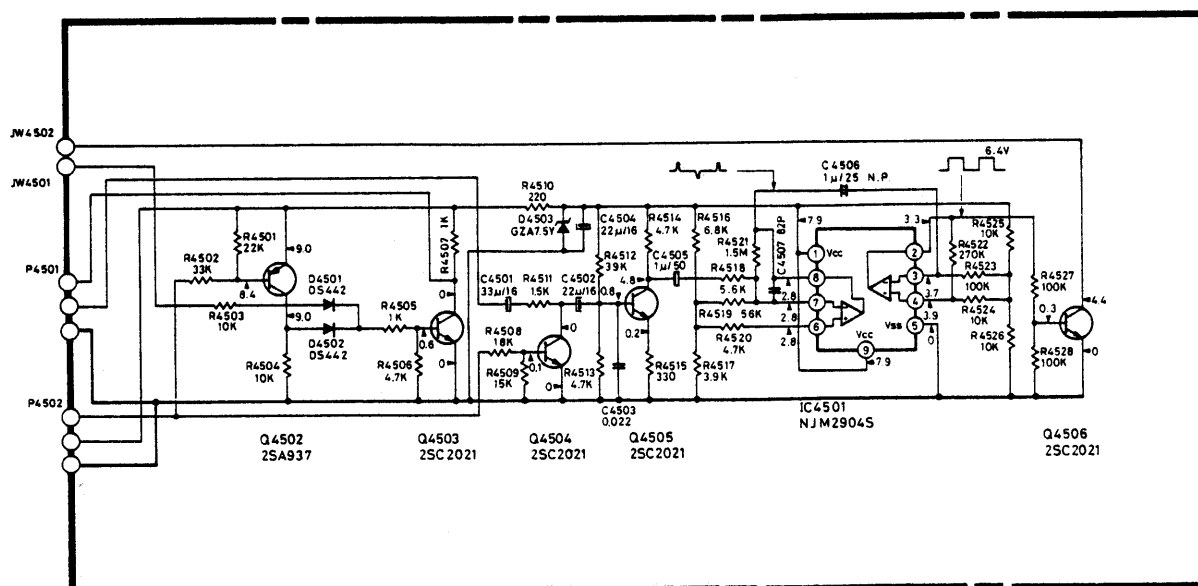


Fig. 2-2-10 Control pulse REC/PLAY circuit

C. SYSTEM CONTROL CIRCUIT

1. SUMMARY

a. Principal functions of the system control circuit

- (1) Controls all VCR modes, according to the input from the operation buttons (mode logic control).
- (2) Controls all 4 motors (head, capstan, reel, and loading motors) to drive the mechanism.
- (3) Controls detection functions of each of the sensors (dew, tape-end, and reel base rotation sensors), and controls automatic stopping of the VCR.
- (4) Transmits control signals to the video, audio, servo, and timer circuits.

Fig. 2-3-1 shows the block diagram of the system control circuit.

b. Principal features

- (1) An N-channel, 4-bit, 1-chip LM6402 microcomputer is used for mechanism control.
- (2) Circuit simplicity is achieved by using an LA7011 in the tape-end sensor circuit for detecting the end of the tape, and LA2400 in the dew sensor circuit.
- (3) IC BA6209 is used to control the forward/reverse rotations of the reel motor.
- (4) ICM54543L is used to control the forward/reverse rotations of the loading motor.

c. New circuits

- (1) LM6402 has been developed for use as a mechanism control microcomputer in this model.
- (2) BA6290 is used as an IC for drive and forward/reverse rotation control of the reel motor.
- (3) M54543L is used as an IC for drive and forward/reverse rotation control of the loading motor.

2. EXPLANATION OF EACH MODE

Determined by the input from the control buttons, this model's functions are divided into the following modes:

- (a) LOADING mode
- (b) UNLOADING mode
- (c) STOP mode
- (d) REC mode
- (e) PLAY mode
- (f) PAUSE mode
- (g) STILL mode (however, the image is muted)
- (h) STOP-PAUSE mode
- (i) F-SEARCH mode
- (j) R-SEARCH mode
- (k) F FWD mode
- (l) REW mode
- (m) CASSETTE-UP mode

In previous models all modes except CASSETTE UP, LOADING, and UNLOADING were carried out in the loaded condition. However, in this model, depending on the mode except for the LOADING and UNLOADING modes, the position of the loading disc is determined as follows: the STOP mode and CASSETTE UP mode are performed in the unloaded position (referred to as STOP position below), the F FWD mode and REW mode are performed in the half-loaded position (referred to as FF/REW position below), and all other modes are performed in the loaded position (referred to as PLAY position below). Also, when the position for the loading disc moves to that for a different mode it goes through the LOADING mode and UNLOADING mode.

Since the STOP mode is in the unloaded position in this model, when recording or playback is performed from the STOP position, first loading is performed and then it goes to the recording or playback condition when either one of those operational buttons is pressed. Because this takes time, a STOP-PAUSE mode has been newly added which makes it possible to press the PAUSE button during the STOP mode so that loading is performed and the unit is ready for the next operation.

The logic table for the operation buttons is shown in Table 2-3-1, and the signal flows occurring in each mode are shown in Fig. 2-3-2 ~ Fig. 2-3-11.

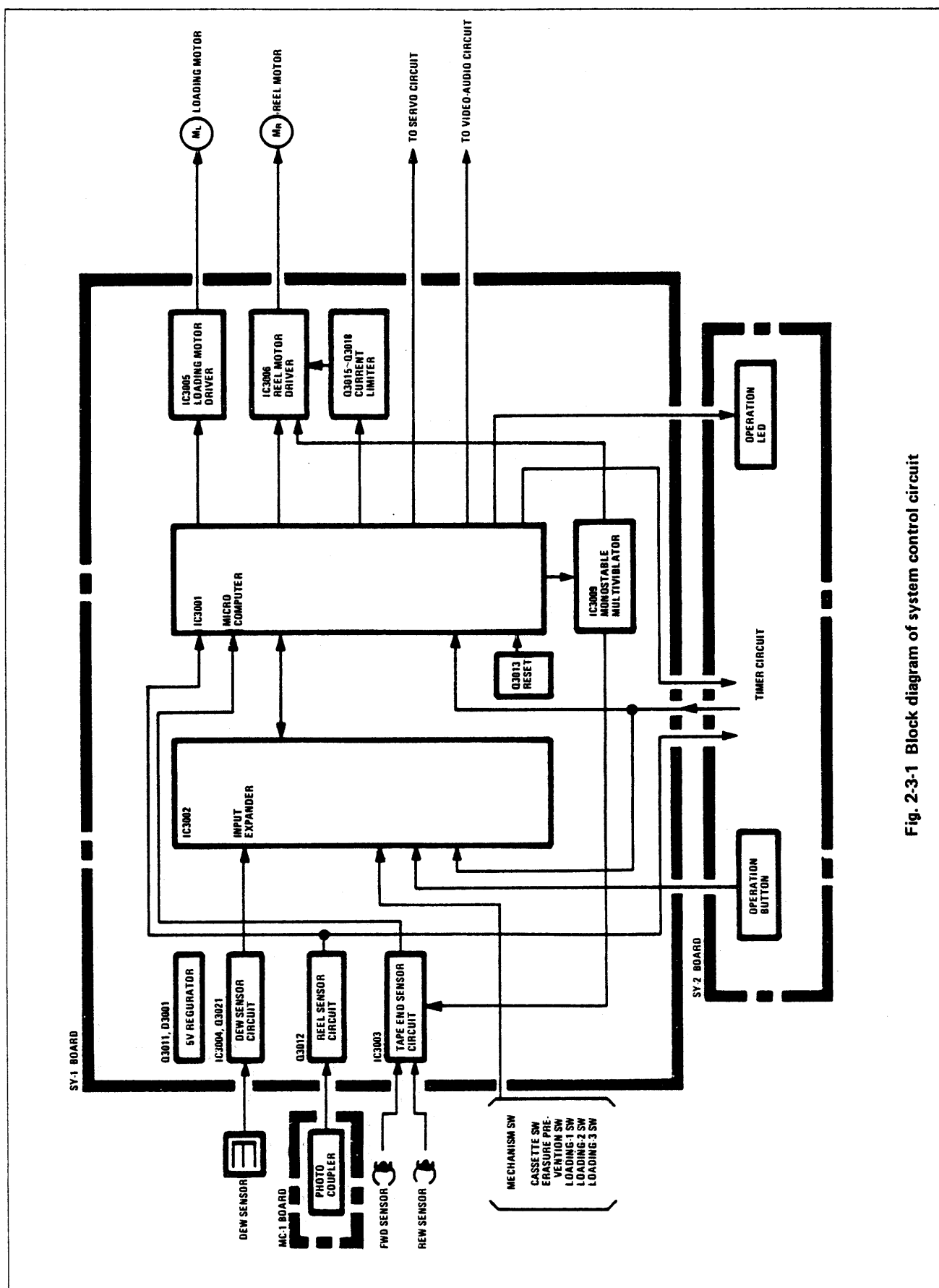
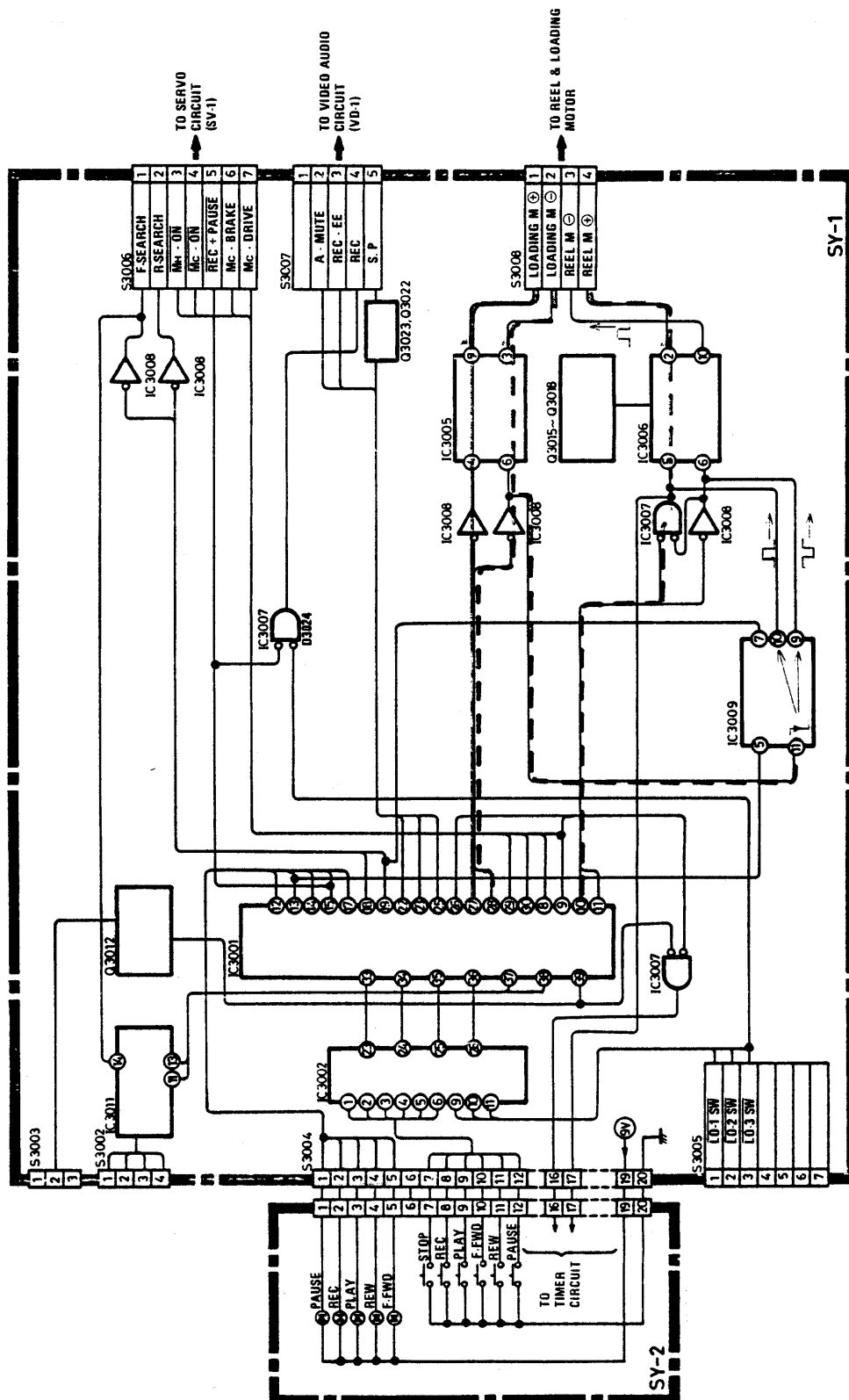


Fig. 2-3-1 Block diagram of system control circuit

Button sensor input Previous mode	STOP	PLAY	STILL/ PAUSE	REC + PLAY	REMOVED TAB CASSETTE REC + PLAY	REC	F FWD/ F SEARCH	REW/ R SEARCH	REMOTE PAUSE ON	REMOTE PAUSE OFF	TAPE END SENSOR	REEL STAND SENSOR	DEW SENSOR
STOP	—	LOADING ↓ PLAY	LOADING ↓ STOP- PAUSE	*1 LOADING ↓ REC	*3 —	—	LOADING ↓ F FWD	LOADING ↓ REW	—	—	/	/	—
PLAY	UNLOADING ↓ STOP	—	STILL	—	—	—	F SEARCH	R SEARCH	STILL	—	UNLOADING ↓ STOP	*5 STOP	UNLOADING ↓ STOP
REC	UNLOADING ↓ STOP	—	SHORT REW ↓ PAUSE	—	/	—	—	—	SHORT REW ↓ PAUSE	—	UNLOADING ↓ STOP	*5 STOP	UNLOADING ↓ STOP
STILL	UNLOADING ↓ STOP	—	PLAY	SHORT REW ↓ PAUSE	—	SHORT REW ↓ PAUSE	—	—	—	PLAY	/	/	UNLOADING ↓ STOP
PAUSE	UNLOADING ↓ STOP	STILL	REC	—	/	—	—	—	—	REC	/	/	UNLOADING ↓ STOP
STOP- PAUSE	UNLOADING ↓ STOP	STILL	—	SHORT REW ↓ PAUSE	STILL	SHORT REW ↓ PAUSE	—	—	—	—	/	/	UNLOADING ↓ STOP
F FWD	UNLOADING ↓ STOP	UNLOADING ↓ LOADING ↓ PLAY	—	*2 UNLOADING ↓ LOADING ↓ REC	*4 UNLOADING ↓ STOP	—	—	REW	—	—	UNLOADING ↓ STOP	*5 LOADING ↓ STOP	UNLOADING ↓ STOP
REW	UNLOADING ↓ STOP	UNLOADING ↓ LOADING ↓ PLAY	—	*2 UNLOADING ↓ LOADING ↓ REC	*4 UNLOADING ↓ STOP	—	F FWD	—	—	—	UNLOADING ↓ STOP	*5 LOADING ↓ STOP	UNLOADING ↓ STOP
F SEARCH	UNLOADING ↓ STOP	PLAY	—	PLAY	PLAY	—	—	R SEARCH	—	—	UNLOADING ↓ STOP	*5 STOP	UNLOADING ↓ STOP
R SEARCH	UNLOADING ↓ STOP	PLAY	—	PLAY	PLAY	—	F FWD	—	—	—	UNLOADING ↓ STOP	*5 STOP	UNLOADING ↓ STOP
TIMER REC	—	—	—	—	/	—	—	—	—	—	UNLOADING ↓ STOP	UNLOADING ↓ STOP	UNLOADING ↓ STOP

NOTE: *1. The microcomputer is sometimes reset. (Sometimes switches to STOP)
*2. The microcomputer is reset. (Sometimes switches to PLAY or STOP)
*3. The microcomputer is reset. (The reel is forwarded only a little)
*4. The microcomputer is reset. (Sometimes switches to PLAY)
*1 ~ *4 will change as in the above chart when the button is continuously depressed.
*5. Goes to STOP when loading is completed. This represents STOP-PAUSE.

Table 2-3-1 Operation buttons logic



Note: $\neg$ is Unloading end.

Fig. 2-3-2 Signals flow chart for the Loading mode and Unloading mode

Loading mode : ———
Unloading mode: - - - -

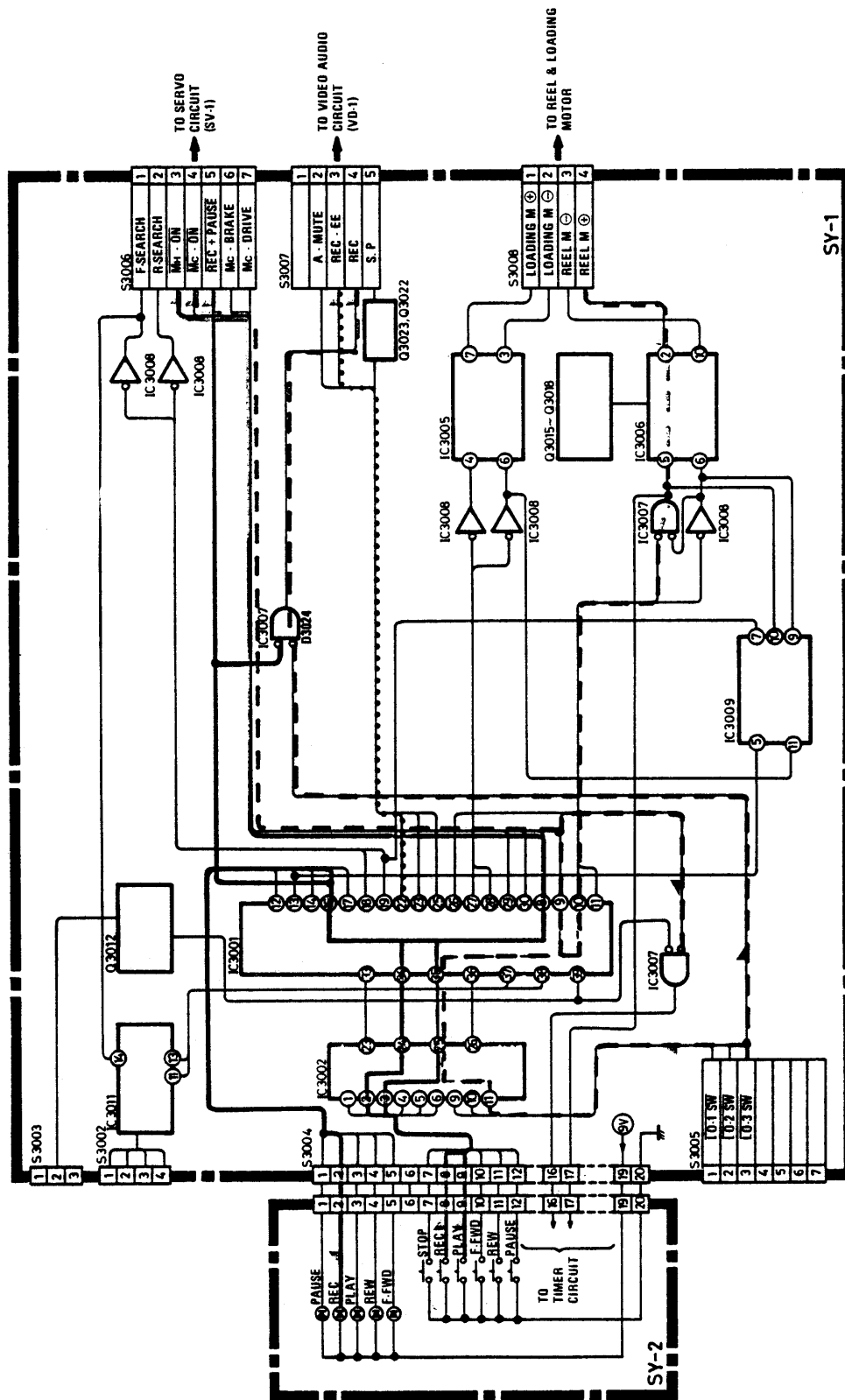
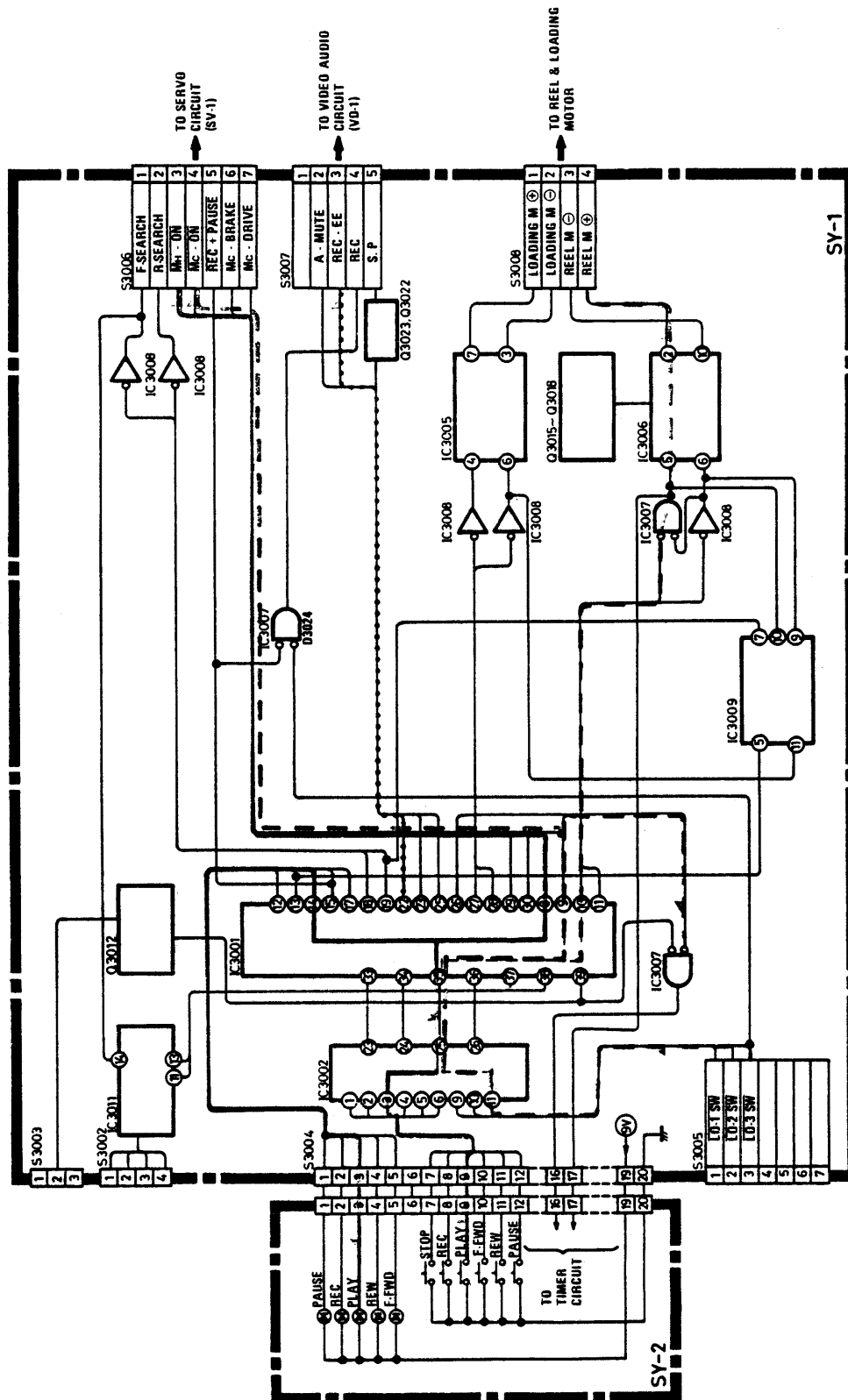
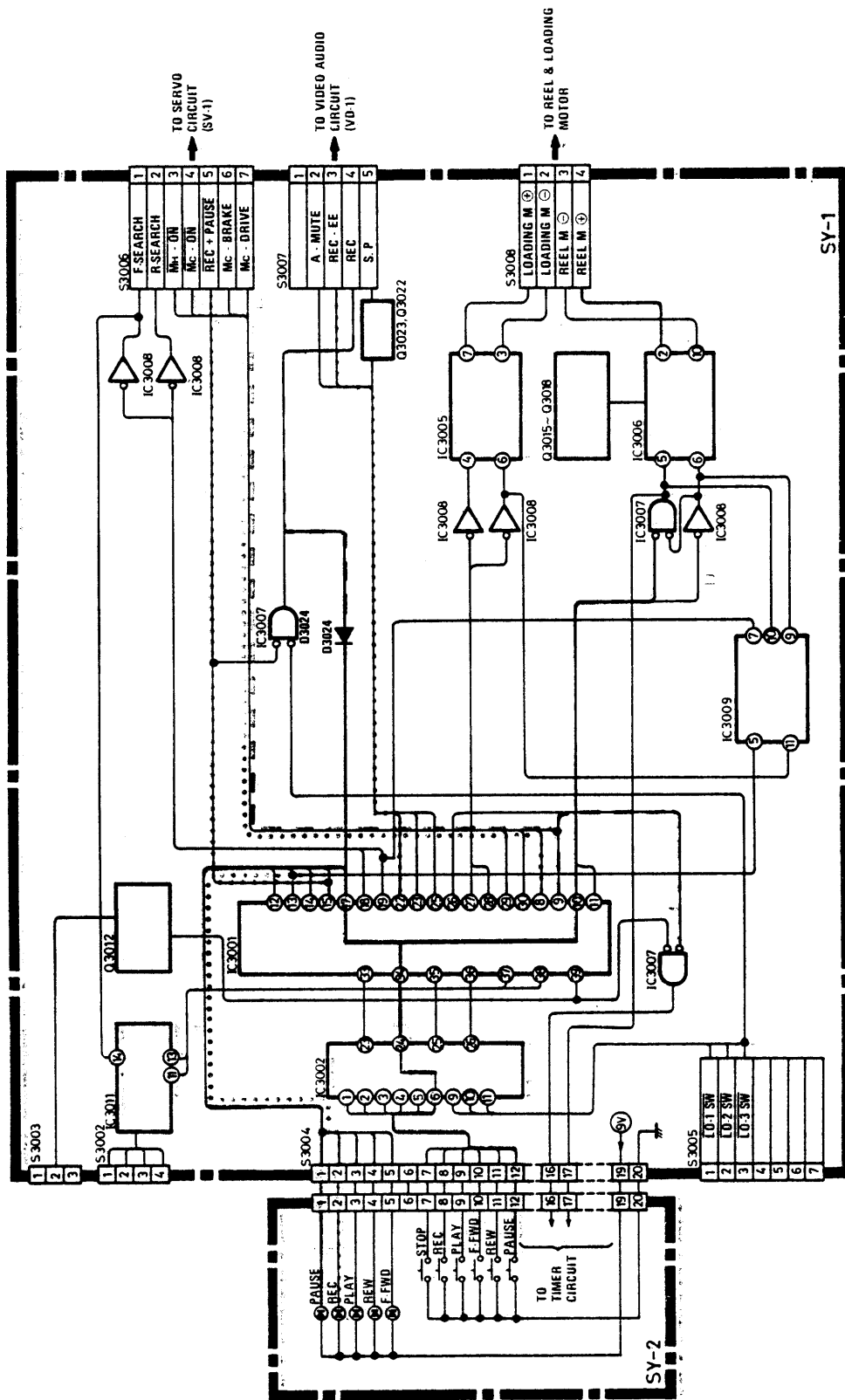


Fig. 2-3-3 Signals flow chart for the REC mode



When the PLAY button is ON:
 When the LO-3 switch is ON, :
 Signal which flow for only one second after the LO-3 switch becomes ON, :



When the PAUSE button is ON.
 (Signal which flows between IC3001 and S3008 one second after going the PAUSE mode.)
 Signal-output in the REC mode

Fig. 2-3-5 Signal flow chart PAUSE mode

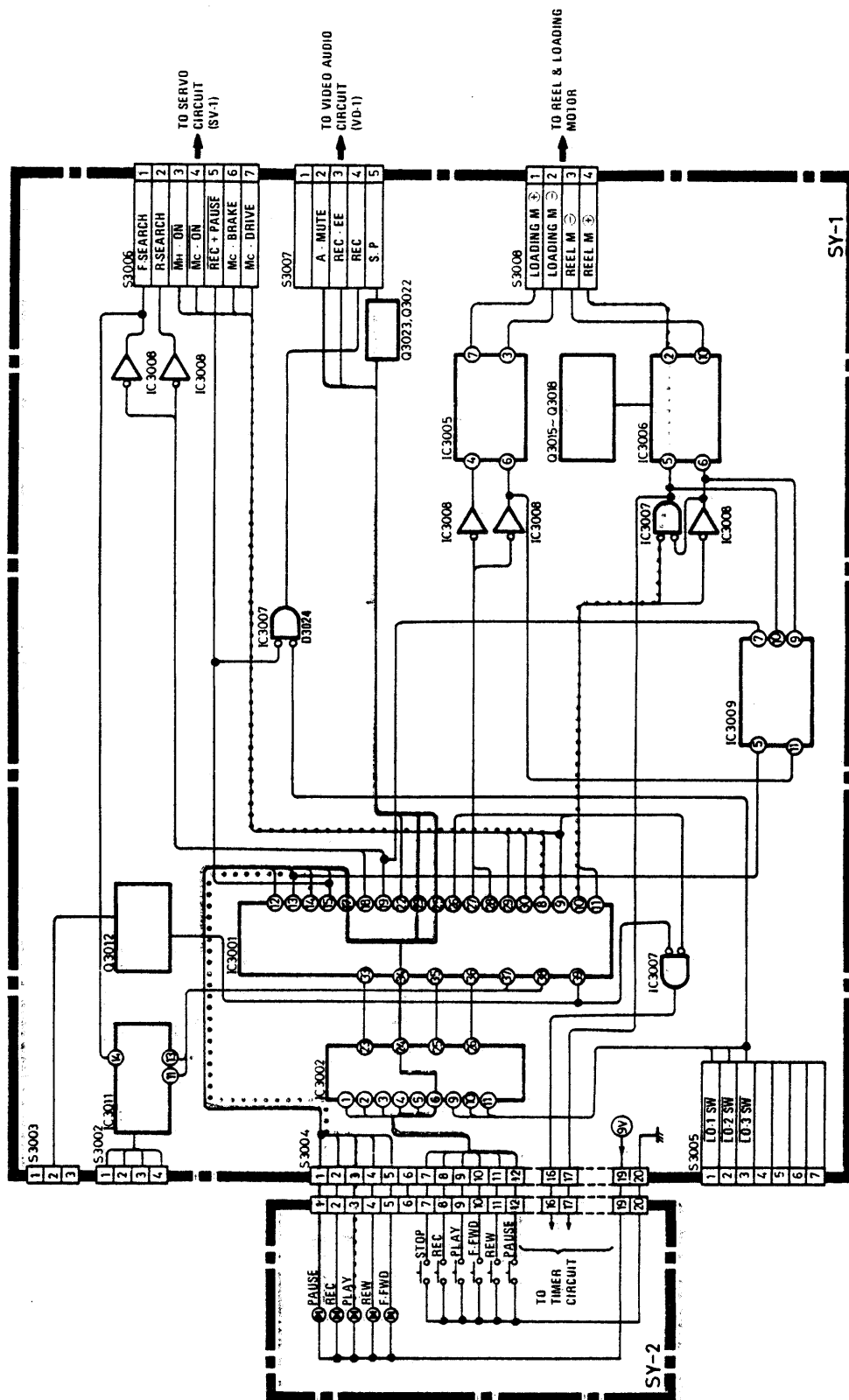
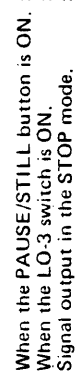
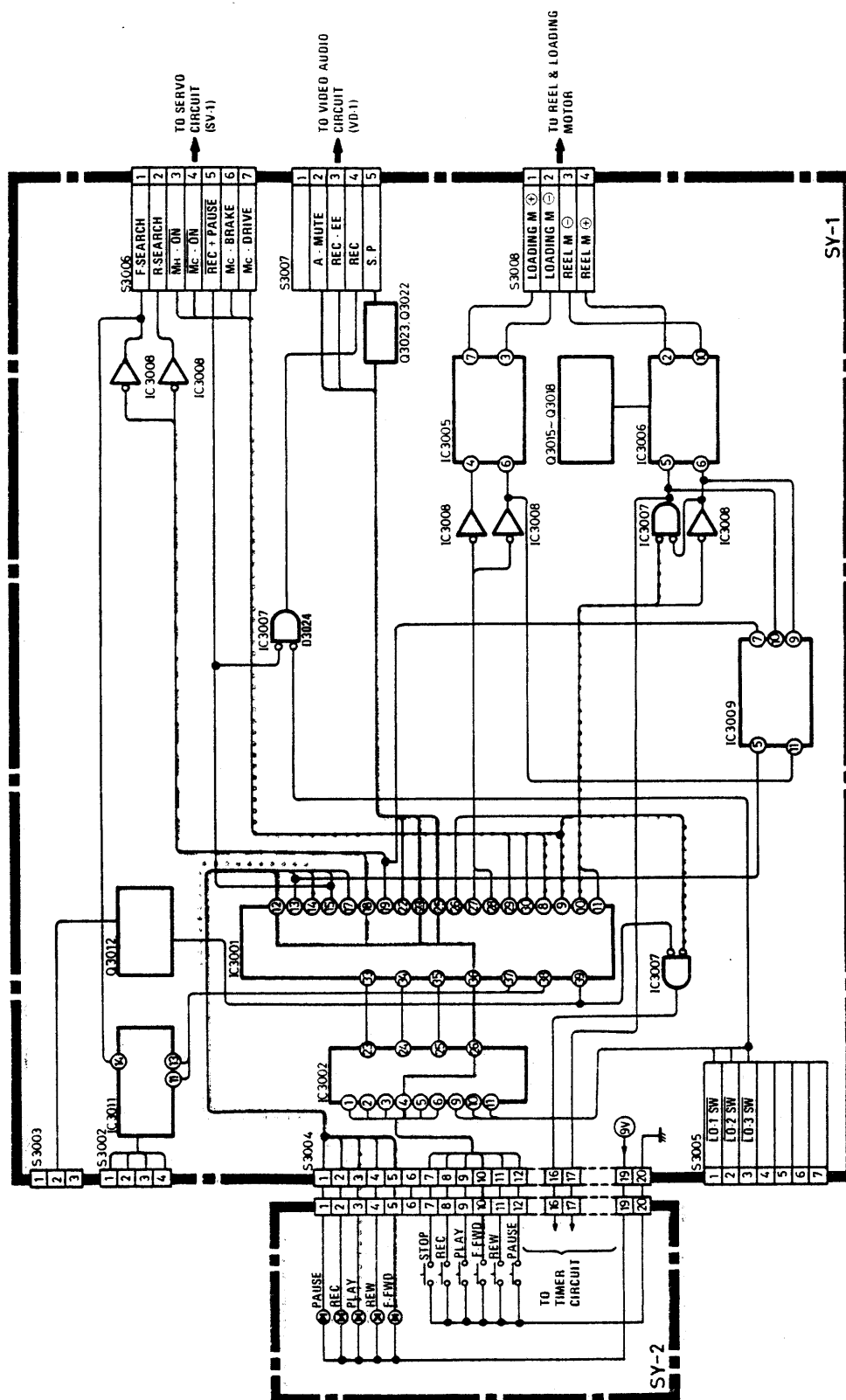


Fig. 2-3-6 Signal flow chart for the STILL mode

When the STILL button is ON, ...
Signal output in the PLAY mode, ...



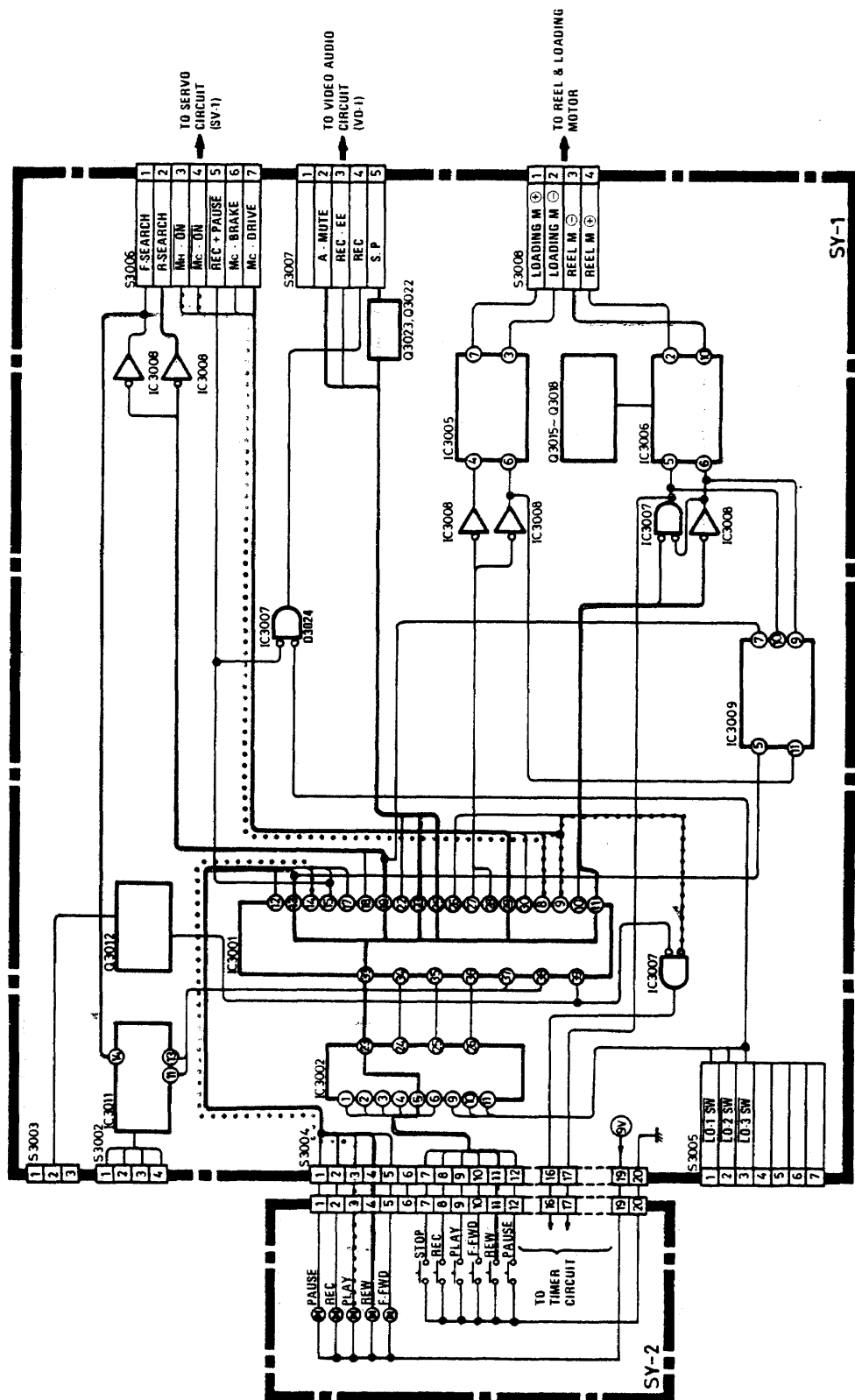
-31-



When the F FWD button is ON, :
Signal output in the PLAY mode, :

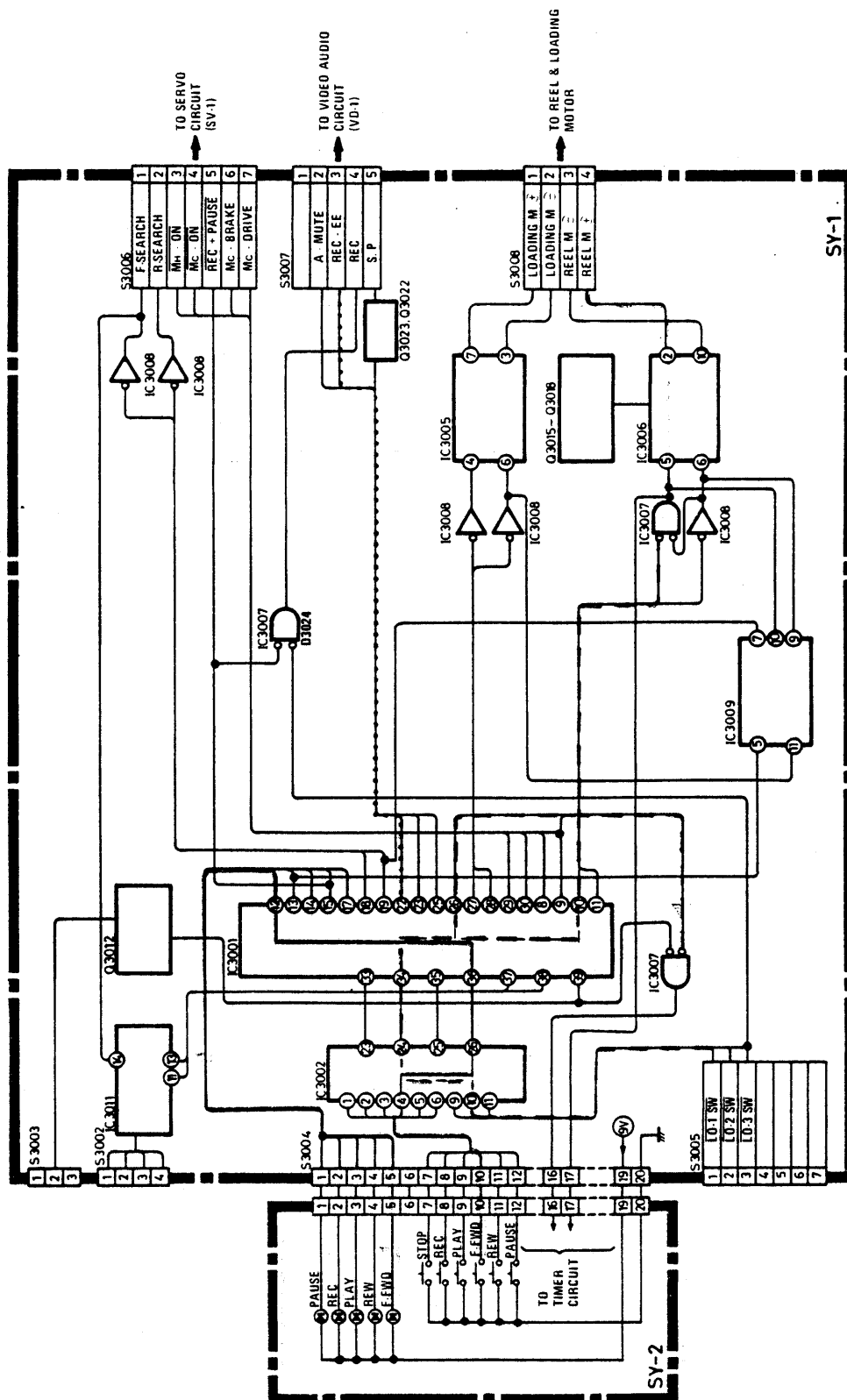
Signal which flow 0.3 second after-
going to the F FWD button is ON.

Fig. 2-3-8 Signal flow chart for the F SEARCH mode



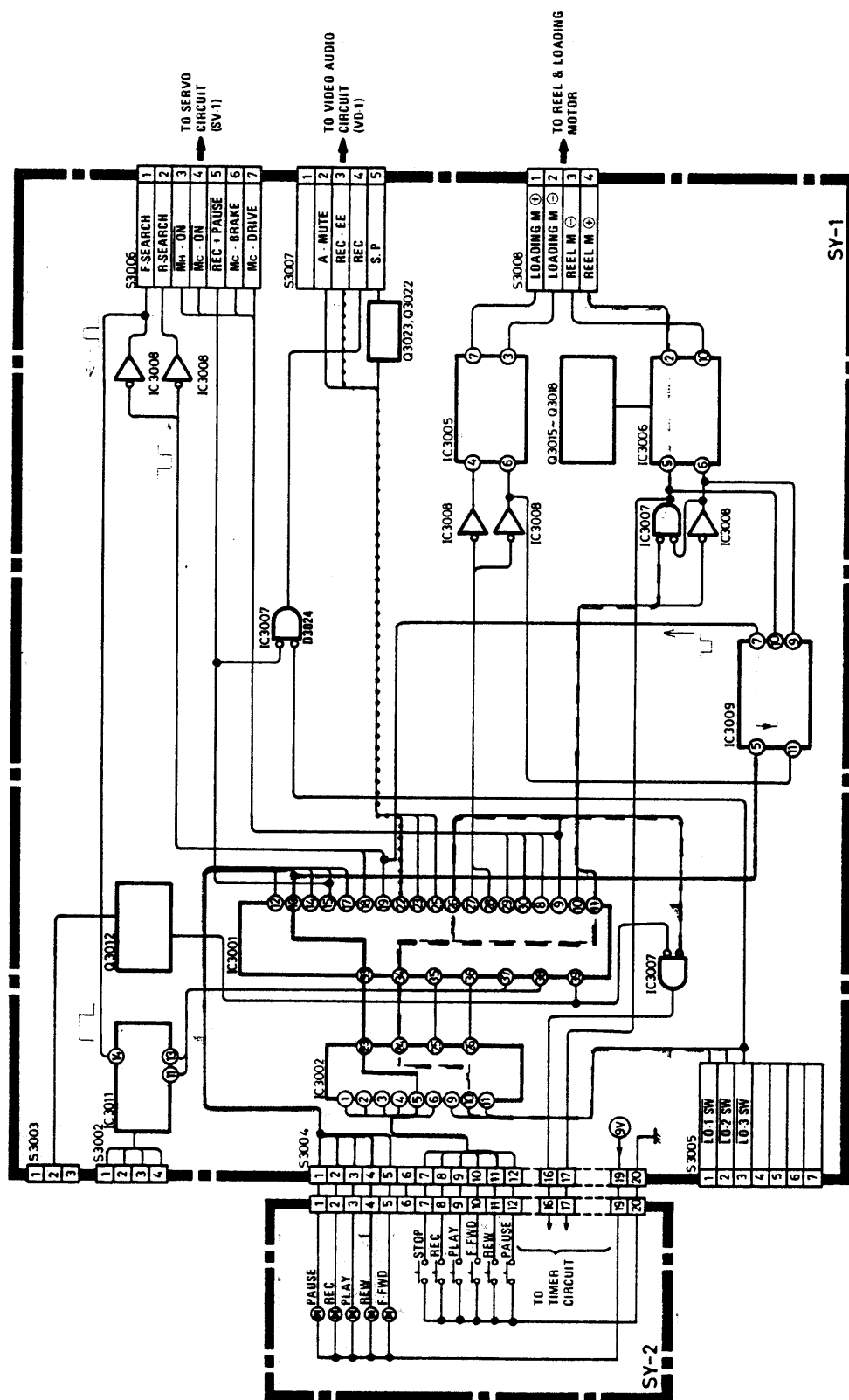
When the REW button is ON.
Signal output in the PLAY mode.

Fig. 2-3-9 Signal flow chart for the R SEARCH mode



When the F FWD button is ON.
 When the LO-2 switch is ON.
 Signal output in the STOP mode.

Fig. 2-3-10 Signal flow chart for the F FWD mode



When the REW button is ON.
 When the LO-2 switch is ON.
 Signal output in the STOP mode.

Fig. 2-3-11 Signal flow chart for the REW mode

3. Safety features

a. Tape end sensor mechanism

Unloading is begun when the tape end is detected by the REW or FWD sensor during tape travel. When unloading is completed, the VCR goes to the STOP mode. (However, when the tape end is detected in the rewind mode unloading is performed after a short F FWD has been performed so that the next loading can be performed smoothly.) This helps to protect the tape at the tape end.

b. Dew sensor function

As a result of sudden changes in temperature or humidity, dew may form on the drum surface. The dew sensor detects this condensation and changes the VCR to the STOP mode, protecting both tape and mechanism from damage.

When the dew sensor is activated, the DEW LED illuminates, and the only operation possible is cassette unloading; all other operation and modes are unusable.

c. Take-up reel base rotation detection

If the reel motor is damaged or a belt breaks and the take-up reel base therefore stops while in any mode in which the tape is driven, the tape will slacken, resulting in possible damage to the tape.

To prevent this from happening, a detection mechanism using a photocoupler and a notch in the take-up reel base has been built-in to detect the take-up reel base rotation. If the take-up reel base is rotating, the notch is detected by the photocoupler and a pulse signal is generated.

If the take-up reel base stops, the pulse signal ceases to be generated; the stopping of the reel base is thus detected and the VCR is automatically switched to the STOP mode, stopping tape travel and protecting the tape from damage.

When the take-up reel base stops, pulses are not received anymore, and the stopping of the reel base is detected. In order to prevent tape slack, loading is completed and tape travel is stopped, preventing damage to the tape.

d. Pause/still automatic cancellation function

If the video head drum continues rotating while the tape is stopped for an extended period of time, the video heads will be excessively worn.

To prevent this, if any of the PAUSE, STILL, or STOP-PAUSE modes continues for 5 minutes, the VCR automatically switches to the STOP mode.

4. Circuit Description

a. Microcomputer and input expander

The microcomputer (LM6402) and input expander (LC7800) are the same as in the previous model. Please refer back. The program for the microcomputer, however, has been changed to conform to the mechanism in this model.

The timing chart for the signal between the microcomputer and input expander is shown in Fig. 2-3-13.

b. Tape end sensor circuit

The tape end sensor circuit, too, is basically the same as that used in the previous model, so only the differences will be explained here.

Since the construction of this model is such that the REW sensor functions only in the REV SEARCH mode and the FWD sensor functions in all the other modes, the switch for pin (14) of IC3003 is HIGH only in the REV SEARCH mode. Moreover, when the FWD sensor functions during the REW mode, IC3007 and Q3014 are utilized and the REW sensor input for the microcomputer is made LOW level.

c. Dew sensor circuit

The dew sensor circuit is shown in Fig. 2-3-12.

The resistance value for the dew sensor increases as condensation forms on the drum. The resistance value is greater than 1000 Mohm when the drum is dry and 20 ~ 200 kohm when condensation forms.

When condensation forms on the drum, Q3021 becomes ON, the voltage of pin (8) of IC3004 drops, pin (2) of IC3004 and pin (12) of IC3002 become LOW and the VCR automatically stops.

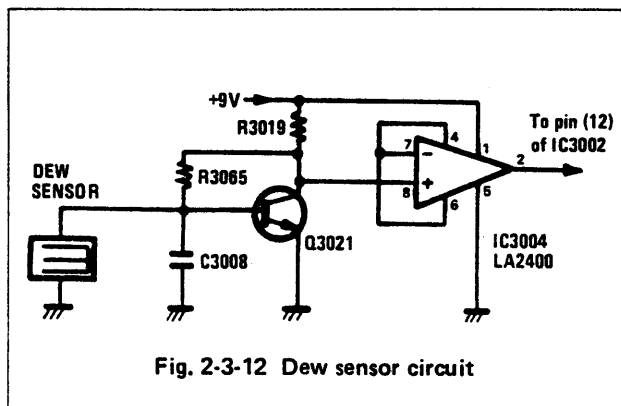


Fig. 2-3-12 Dew sensor circuit

d. Reel base rotation sensor

As for the rotation of the take-up reel base, the short wave form produced by the notched portion of the take-up reel base and the photocoupler is amplified by Q3012 and input to pin (39) of IC3001. If there are not 2 level changes for 3 seconds, the microcomputer judges that the rotation of the reel base has stopped, and the VCR automatically stops after loading.

In this condition only the STOP button is received.

Also, when the reel base rotation sensor functions during unloading, the power cord must be disconnected once before another operation can be performed.

The short wave form obtained by the reel base rotation sensor, passes through IC3007 and is sent to the timer circuit as a count pulse.

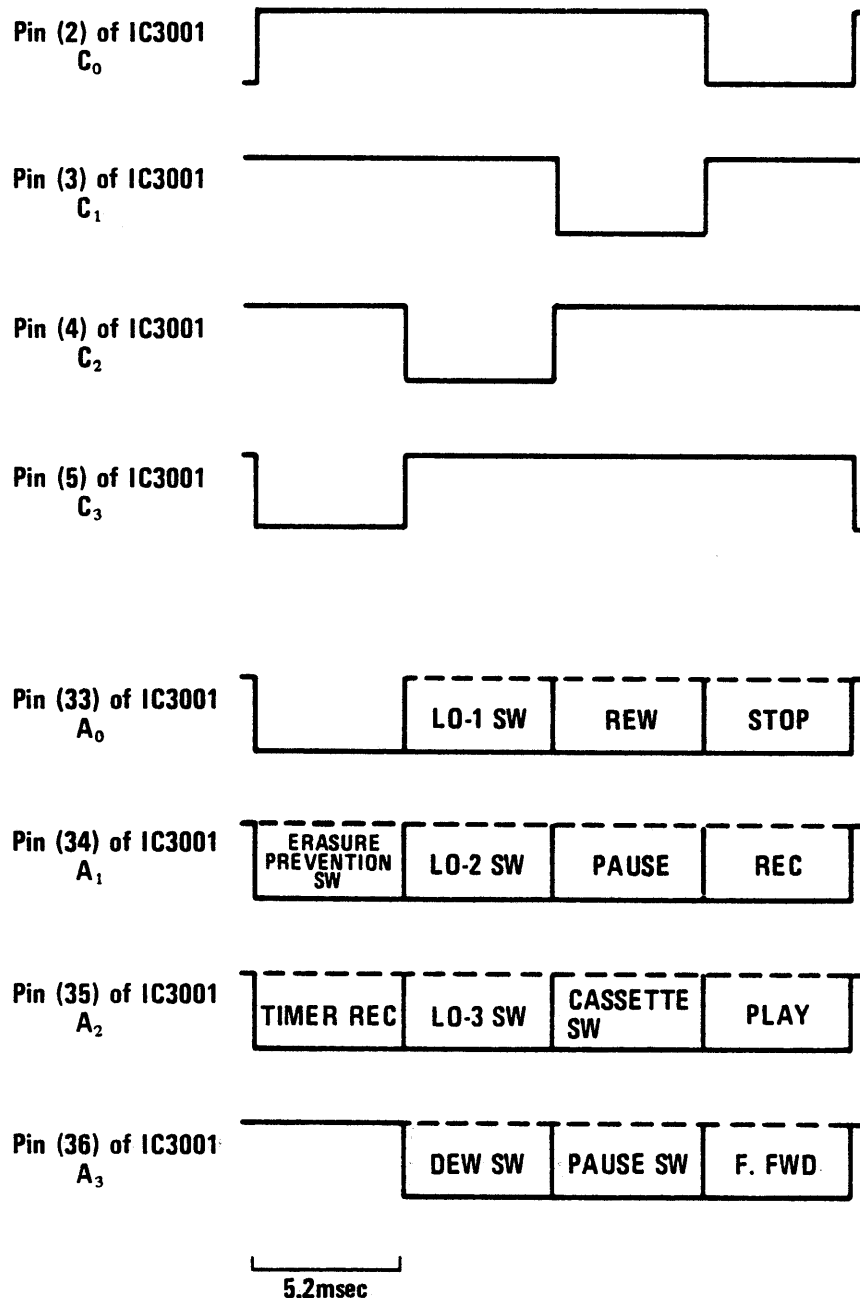


Fig. 2-3-13 Microcomputer (LM6402) Timing chart

e. Reel motor drive circuit

The reel motor drive circuit is shown in Fig. 2-3-14.

IC3006 controls the reel motor drive, forward and reverse rotation; the direction of rotation is decided by the output signal, $\overline{MR-F}$ and $\overline{MR-R}$, from IC3001. (forward when $\overline{MR-F}$ is LOW and reverse when $\overline{MR-R}$ is LOW)

The pin (4) V_R terminal of IC3006 determines the voltage for the reel motor terminal. When the LO-3 switch is on (the loading disc is in the PLAY position), the voltage (about 3V) determined by Zener diode D3006 is impressed in modes other than FWD SEARCH and REV SEARCH, and the voltage (about 5.7 V) determined by Zener diode D3007 is impressed in the FWD SEARCH and REV SEARCH modes. When the LO-3 switch is off,

the voltage (about 7.5 V) determined by Zener diode D3008 is impressed.

Q3015 ~ Q3018 compose the current limiter circuit. This limits the reel motor current to about 270mA to avoid a high degree of tension in the video tape during unloading. Because the $\overline{ML-R}$ signal becomes LOW during unloading, Q3015 becomes ON. By Q3015 becoming ON, current to the reel motor is supplied by means of R3049. At this time, no more current than that for $V_{BE}/R3049$ of Q3017 can flow to R3049. Namely, the $V_{BE}/R3049$ current is current limited.

Q3019 prevents voltage drops by R3054 in the F FWD or REW mode, and R3086 suppresses the motor starting current.

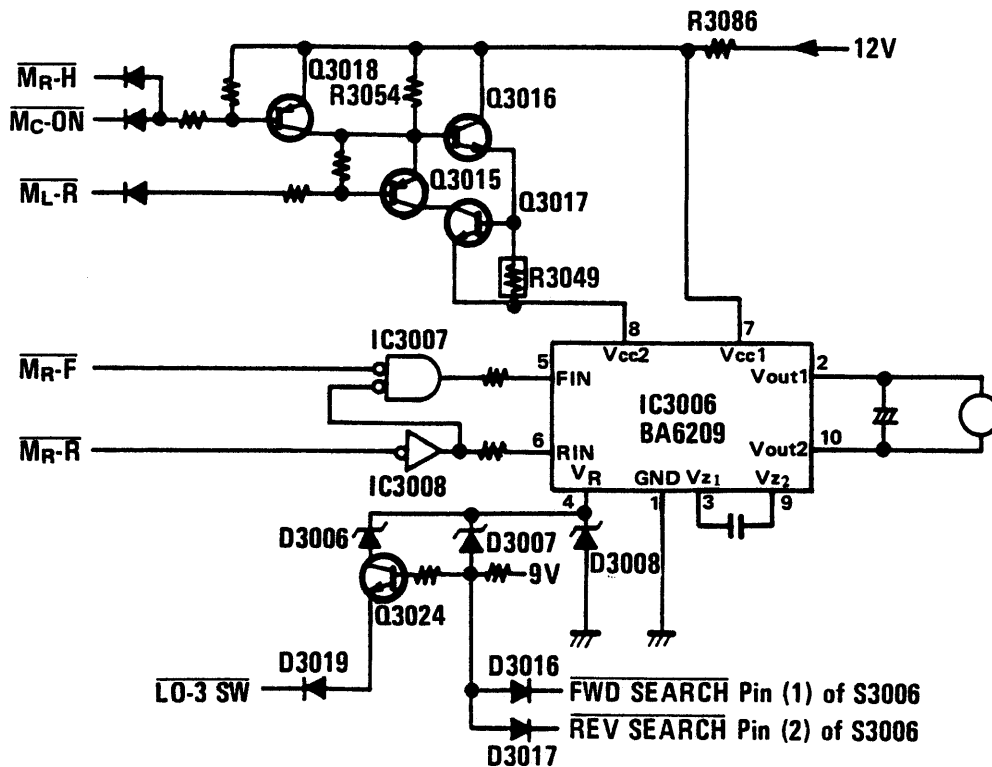


Fig. 2-3-14 Reel motor drive circuit

f. Loading motor drive circuit

The loading motor drive circuit is shown in Fig. 2-3-15. IC3005 controls the loading motor drive, forward or reverse rotation; the direction of rotation is decided by the output signal, $\overline{M_L-F}$ and $\overline{M_L-R}$, from IC3001 (forward

when $\overline{M_L-F}$ is LOW and reverse when $\overline{M_L-R}$ is LOW).

Q3025 delays the loading timing when going from the REW mode to either the PLAY or RECORD mode. Furthermore, R3058 suppresses the motor starting current.

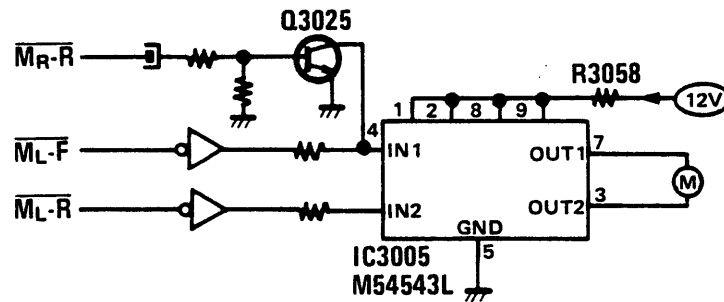


Fig. 2-3-15 Loading motor drive circuit

These timing chart is shown in Fig. 2-3-17.

g. Monostable multivibrator

IC3009 has two monostable multivibrators, and its function is as follows:

- (a) At the beginning of the REW mode, it makes pin (14) of IC3003 HIGH for about 0.4 seconds and cancels tape end detection.

- (b) When unloading is completed, it forwards the loading motor for about 0.25 seconds.

h. Front loading operation

The front loading mechanism that inserts and ejects the cassette is controlled by 4 switches. The timing chart is shown in Fig. 2-3-16.

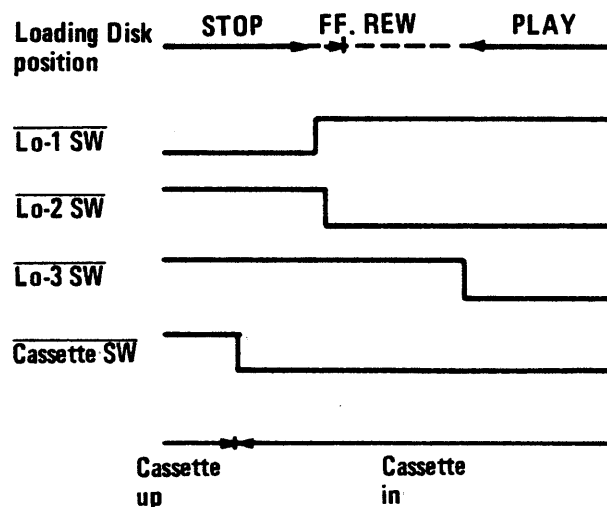


Fig. 2-3-16 Mechanism switch timing chart

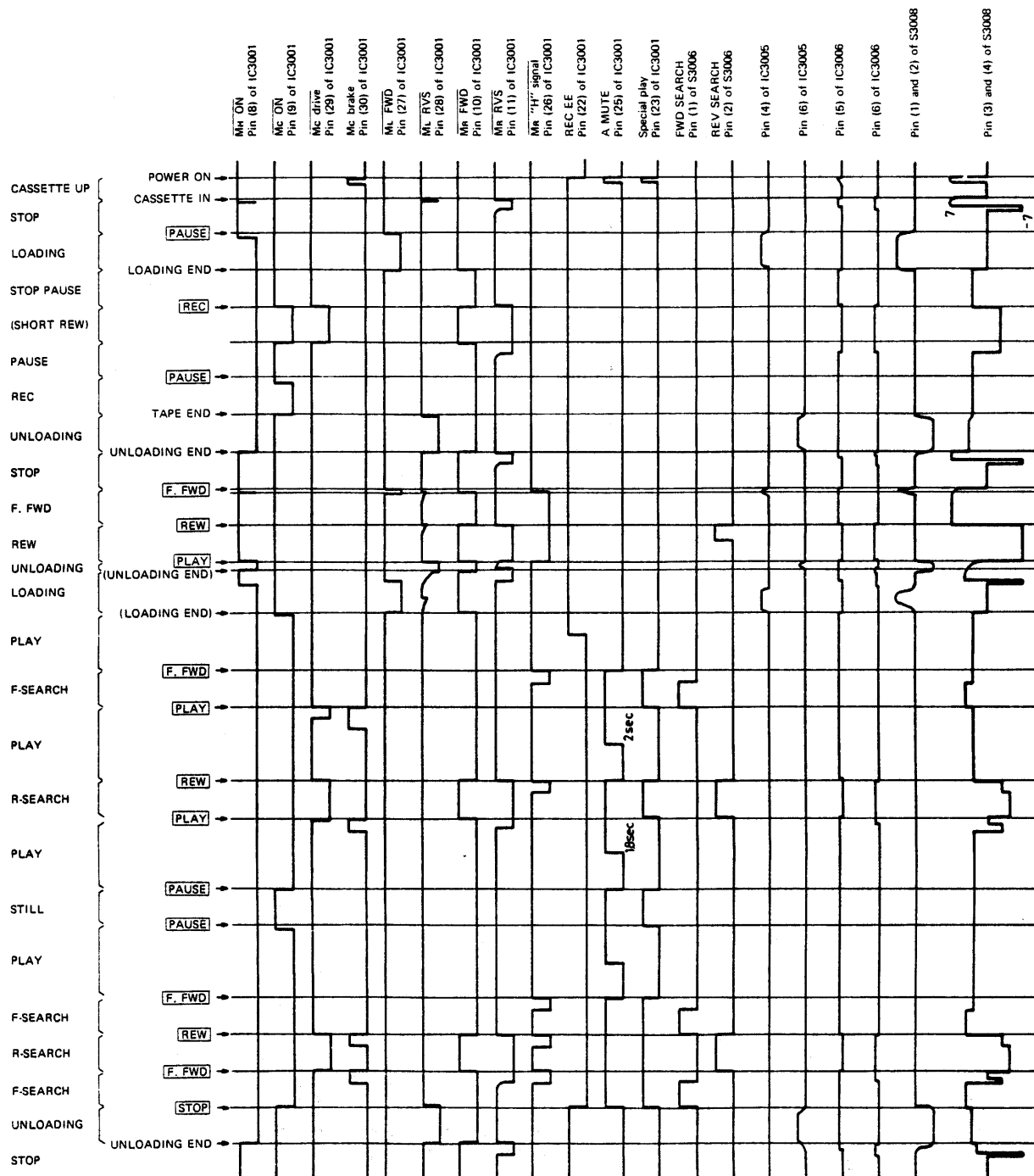


Fig. 2-3-17 Timing chart

D. AUDIO CIRCUIT

1. Outline

The audio circuit (VD-1 circuit board) combines the EQ-amplifier, microphone amplifier, recording amplifier, and the record/playback selection switch into a one-chip IC (IC2001) construction. A block diagram of the audio circuit is shown in Fig. 2-4-1.

2. EE Mode (Refer to Fig. 2-4-1.)

The audio signal input to terminal (3) of S1003 is input to pin (18) of IC2001 and, after being amplified by the microphone amplifier, is output from pin (4).

The signal output from pin (4) of IC2001 passes through the low pass filter, which is composed of L2003 and C2019, and is input to pin (9). After being amplified by the line amplifier, it is output from pin (10) of IC2001. This part is changed to direct current by the rectifier circuit and is input to pin (16) of IC2001. Pin (16) and pin (17) input a direct current to the base of the IC internal circuit which is connected to pin (16) of IC2001. The input of pin (18) is controlled in accordance with the control of the resistance variation between the collector of the IC internal circuit connected to pin (17) and earth. The signal output to pin (10) of IC2001, after being adjusted by VR2001, is input to pin (12), passes through the recording amplifier, and is output from pin (13) of IC2001. In addition, the signal output from pin (13) of IC2001 acts as feedback according to the internal resistance of the IC, and also emphasizes the high frequencies according to the peaking circuit composed of L2002, R2010, and C2010. The signal output from pin (13) of IC2001 also passes through the bias trap composed of L2001 and C2025 and, when Q2001 and Q2002 are released (during recording), is supplied to the audio/control head as recording current.

3. REC Mode (Refer to Fig. 2-4-2.)

Other than in the EE mode, the oscillator circuit (which supplies the audio/control head with a bias current and supplies the audio erase head and the full erase head with an erasing current) operates, and, in conjunction with this, a recording current is supplied to the audio/control head. This is called the REC mode. REC +B is supplied from the video section, passes through R2037 and L2004, and causes oscillation. Simultaneously, Q2001, Q2002, and Q2004 are released by D2004.

4. PLAY Mode (Refer to Fig. 2-4-3.)

Play +B is supplied from the video section. This supplies high level voltage to pin (14) of IC2001. Fig. 2-2-4 shows the relationship between the voltage of pin (14) of IC2001 and each mode.

As shown in Fig. 2-4-4, muting is applied when the voltage of the EE mode, the REC mode, and the PLAY mode reaches approximately its halfway level. When the mute signal (approximately 9 V) from the system control circuit is input to terminal (2) of S1004, Q2005 is switched ON and muting is applied.

As mentioned previously, IC2004 is in a released condition. Therefore, when the signal from the audio/control head is input to pin (2) of IC2001, it is output to pin (4) of IC2001. This signal passes through R2041, C2020, R2020 and C2021, applies negative feedback to pin (3) of IC2001, and composes the equalizer.

The signal output to pin (4) of IC2001 passes through the low pass filter just as during recording, and is input from VR2002 to pin (8); it then passes through the line amplifier, and is output to pin (10) of IC2001.

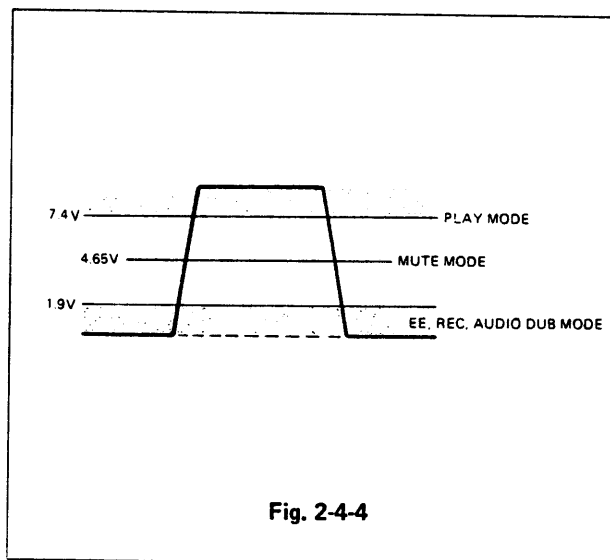


Fig. 2-4-4

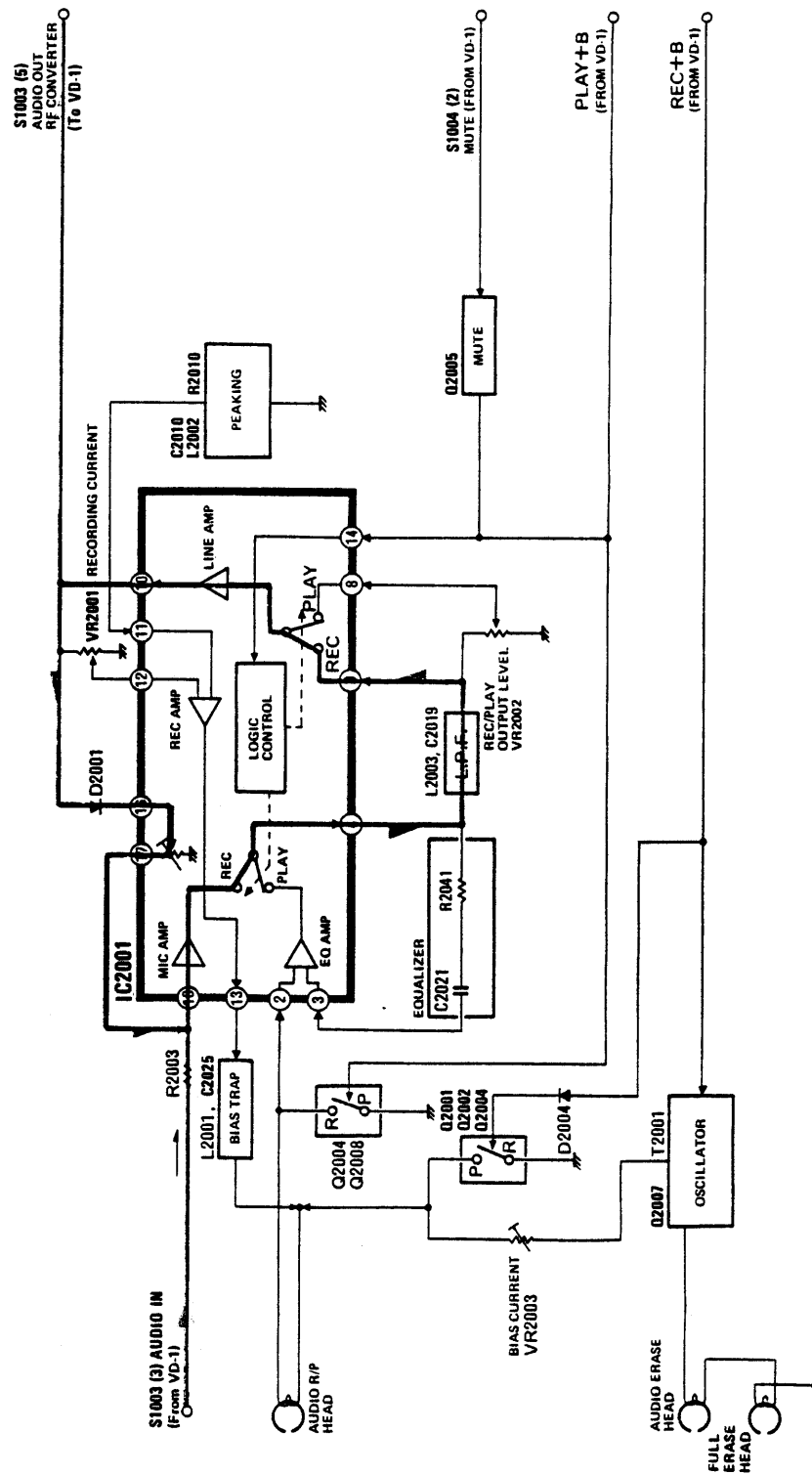
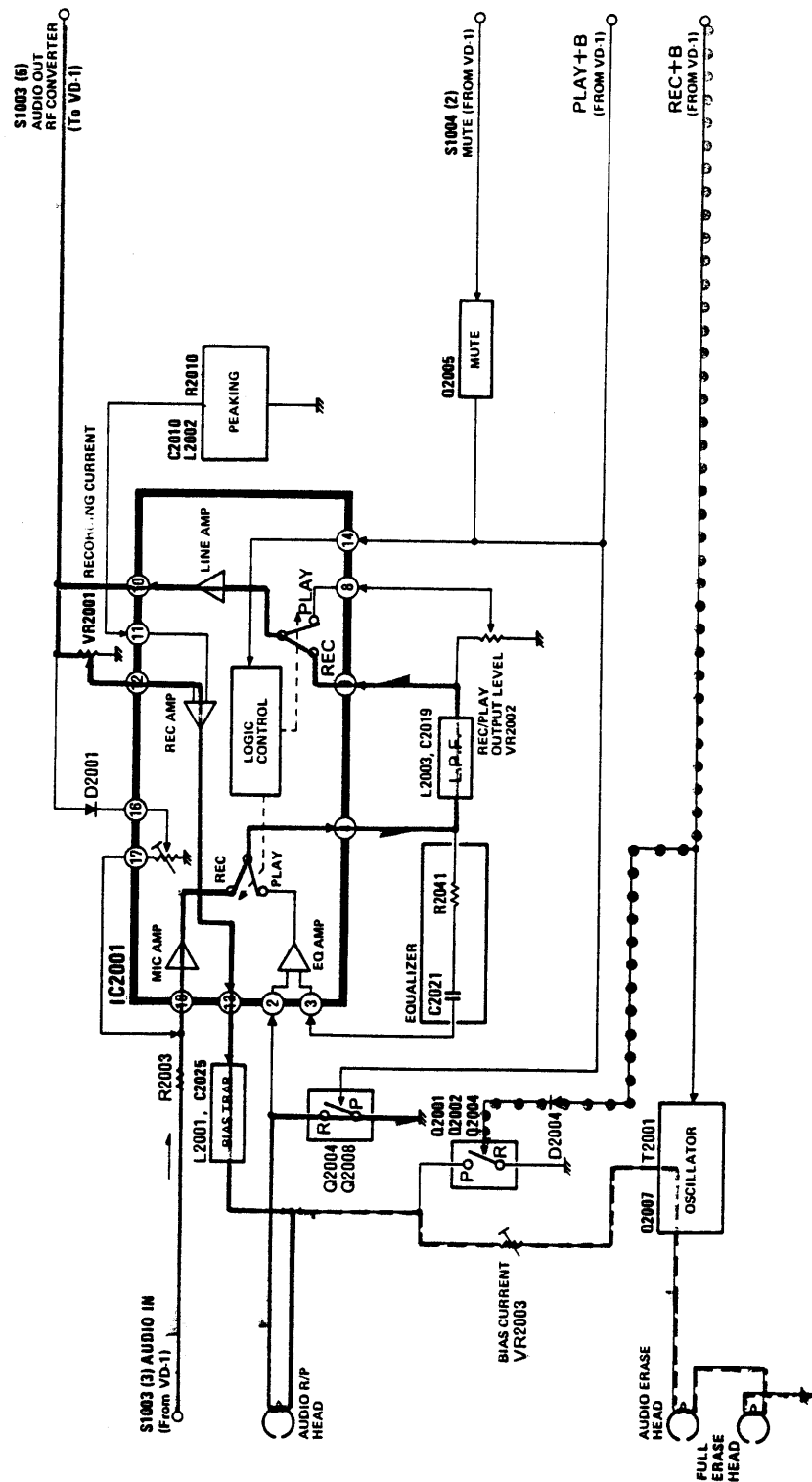


Fig. 2-4-1 Audio Circuit Block Diagram (EE mode)



: AUDIO SIGNAL
 : BIAS, ERASE CURRENT
 : CONTROL SIGNAL

Fig. 2-4-2 Audio Circuit Block Diagram (REC mode)

E. TIMER CIRCUIT

1. SUMMARY

The timer circuit is centered around a microcomputer. In addition to the clock function the functions of the timer circuit include eight-day/one-program timer recording and an electronic counter. The timer and the counter both use the same display tube, and the display can be switched from one to the other.

a. Timer function

This timer is a power supply synchronized timer which uses the power supply frequency as a reference. A single recording starting time and stopping time can be set up to eight days in advance, and it is also possible to set one program for everyday recording.

In the event that the tape end is reached before the stopping time is reached, recording will automatically stop, and the power will be turned off.

b. Counter function:

This counter has a built-in four-digit tape counter function. It can be used by switching the clock display to the counter display.

The counter also has a memory feature. If the memory mark, "M", is illuminated beforehand, tape rewind will automatically stop when the display reads "0000".

2. CIRCUIT COMPOSITION

The timer circuit (circuit board SY-2) block diagram is shown in Fig. 2-5-1.

In addition to the tuner circuit, circuit board SY-2 contains parts of the system control circuit controls, the power switch, etc.

a. Power-timer system

The signals supplied to the timer circuit by the power circuit consist of +9 V (from pin (5) of S3301) for the operation of the microcomputer, AC 2.4 V (from pin (3) and pin (4) of S3301) for the filament of the fluorescent display, -20 V (from pin (2) of S3301) for driving the display, and the TIME BASE signal (from pin (6) of S3301) for use as the clock reference. In addition, the POWER UP signal for the starting of the power circuit is supplied to the power circuit (PW-1) from pin (7) of S3301. Three signals are mixed, and output as POWER UP signals when: (a) the power switch SW3302 is set "ON", (b) the unloading switch (pin (18) of S3303) is "OFF" and the tape is wound around the video drum, and (c) the TIMER REC OUT signal is being output (from (26) pin of IC3301). In other words, power is supplied to the VCR during any one of three conditions.

b. System control — timer system

The signal processing between the system control circuit (SY-1) and the timer circuit (SY-2) includes 20 different signals. Because there are so many signals, harnesses are not used for the signal transfers, but the circuit boards are directly connected (S3303 and S3004) to each other.

The contents of the signals input to and output from pins (1) ~ (13) of S3303 include the indications of the various modes (PLAY, REW, etc.) of the VCR, dew indication, and operation button condition.

The MEMORY REC OUT signal is output from pin (14) of S3303 so that, when the counter reaches "000" during tape rewinding, a 200-millisecond pulse is output and the rewinding operation stops.

Next, a COUNT UP or COUNT DOWN signal is input from pin (15) of S3303. The COUNT UP and COUNT DOWN signals are to indicate that the VCR reel bases are rotating in the forward direction or the reverse direction, respectively. The microcomputer, IC3301, receives these signals and adds to, or subtracts from, the counter total, as appropriate.

The reel base count pulse sent from the reel base sensor is input to pin (16) of S3303.

The square wave which was waveform shaped by Q3303 is input to pin (8) of the microcomputer (IC3301).

The TIMER REC OUT signal is output from pin (17) of S3303 to the system control circuit when the programmed recording starting time is reached, and the system control circuit sets the VCR to the REC mode.

The LO-1SW signal is input from pin (18) of S3303. The LO-1 switch turns on when the tape is in the unloading condition, and the signal is mixed together with the POWER UP signal of pin (7) of S3301.

To give an example of this function: Suppose the VCR is in the PLAY mode and the power switch (SW3302) is set "OFF"; voltage will cease to be applied to the base of Q3308, but instead Q3307 will be on, and the condition will be the same as if the STOP button (SW3312) had been pressed. When this happens, the VCR will enter the STOP mode, and the tape will be unloaded from around the video drum. When the tape is completely returned to the cassette, the LO-1SW signal will become LOW, the POWER UP signal will cease to be output, and the power supply to the VCR will be turned off. In other words, no matter what mode the VCR is in when the power switch is set "OFF" this system will assure that the tape is properly returned to the cassette.

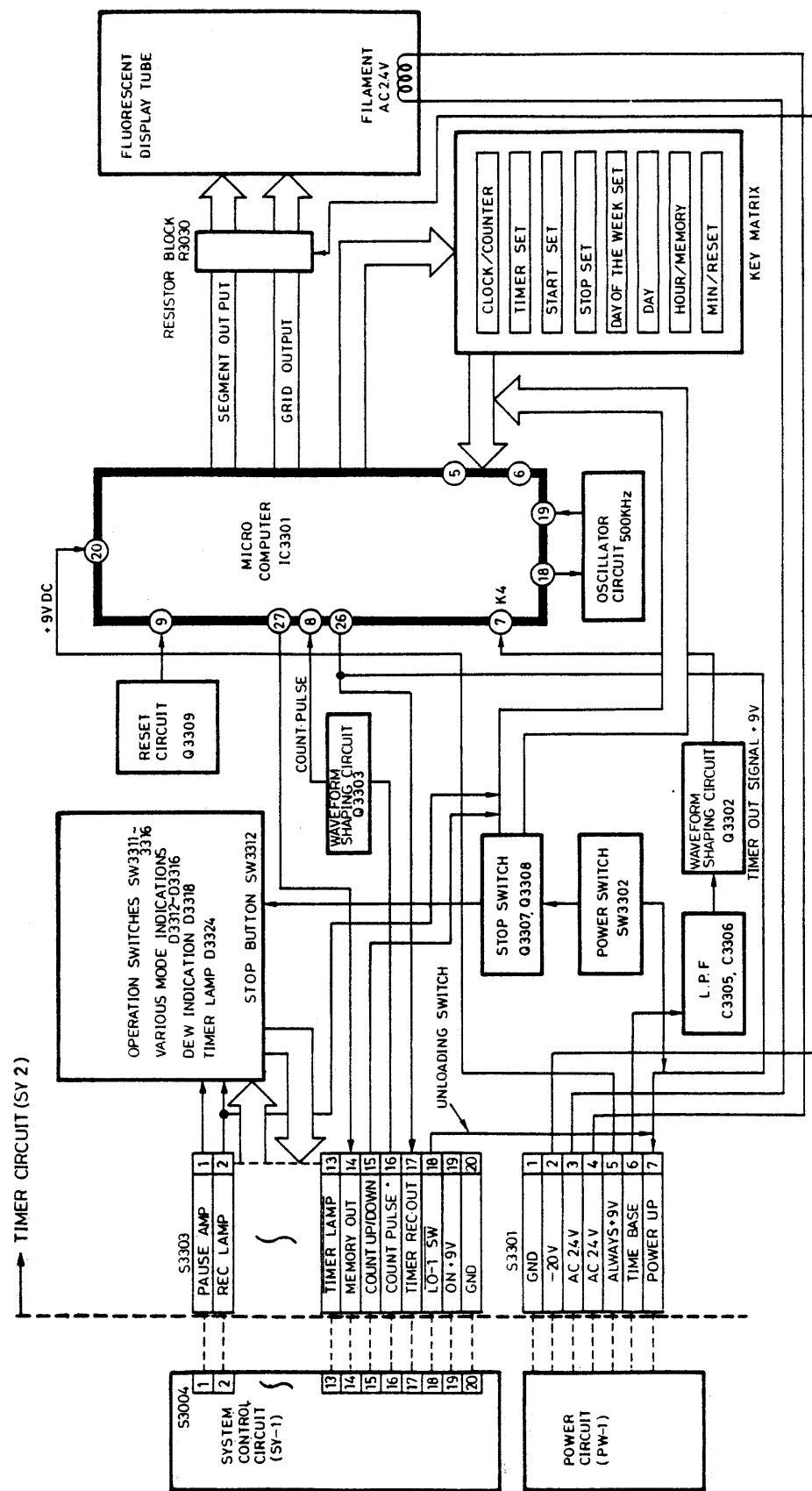


Fig. 2-5-1 Block diagram of timer circuit

3. CIRCUIT DESCRIPTIONS

a. Clock reference counting circuit

The clock reference counting circuit is shown in Fig. 2-5-2. An AC waveform of approximately 50 Vp-p is input to pin (6) of S3301 from power circuit PW-1. The input signal,

after being DC cut by C3304, passes through a low pass filter composed of a resistor and a capacitor, and then, after being waveform shaped by Q3302, is input to pin (7) of IC3301.

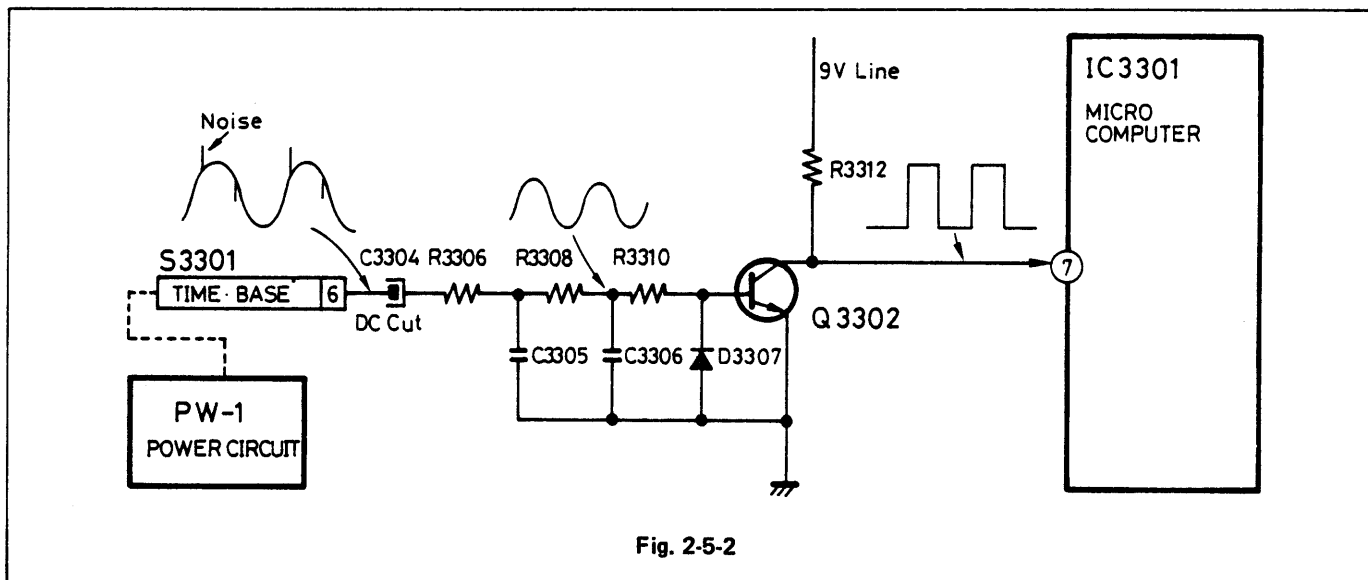


Fig. 2-5-2

b. Fluorescent display outputs

The output signals to the fluorescent display are shown in Fig. 2-5-3.

The fluorescent display uses dynamic illumination. That is to say, the grid illuminates one segment at a time in sequence. As shown in Fig. 2-5-3, the output order is $R_4 \rightarrow R_2 \rightarrow R_0 \rightarrow R_3 \rightarrow R_1$.

At this time, the outputs of the segment signals $O_0 \rightarrow O_7$ are

also changed at the illumination of each segment, and cause the appropriate number to illuminate in each of the various segments.

Because this cycle is extremely fast, to the human eye it appears that all of the segments are illuminated at the same time. The timing chart for all of the outputs is shown in Fig. 2-5-4.

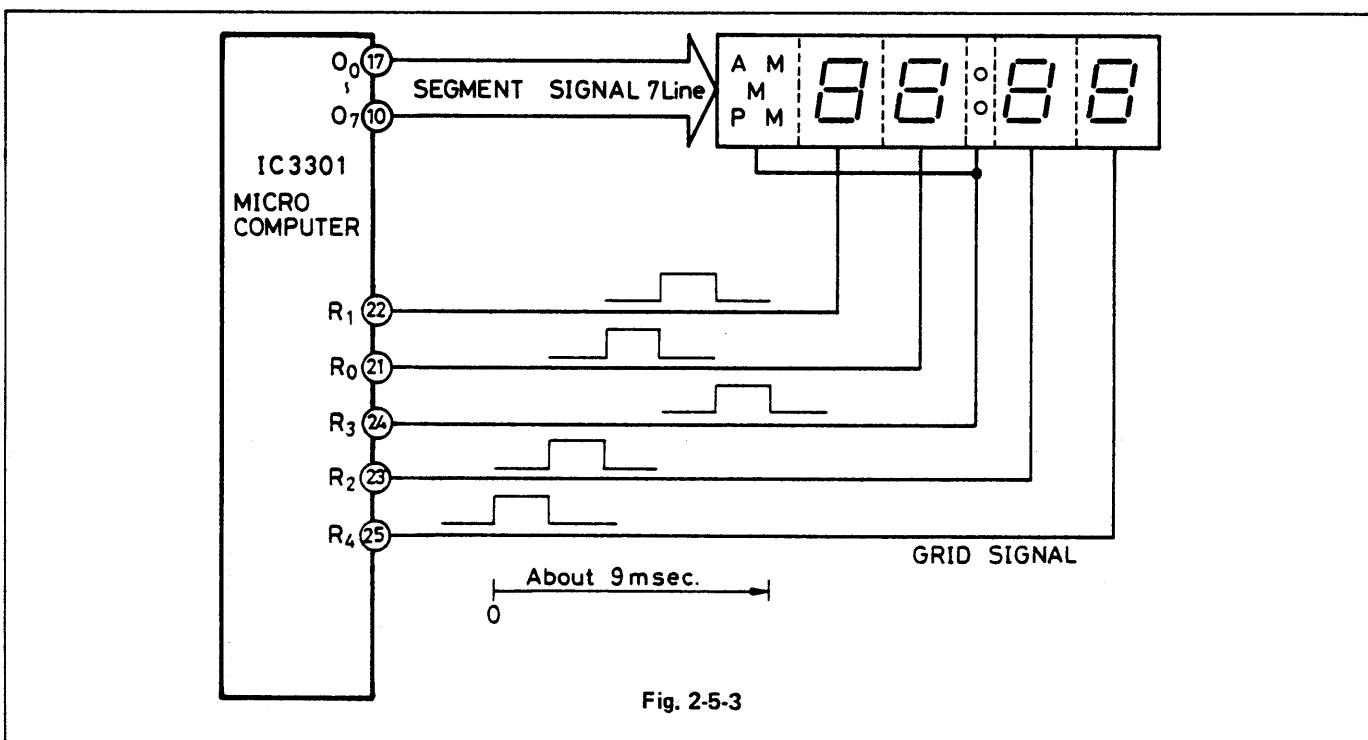


Fig. 2-5-3

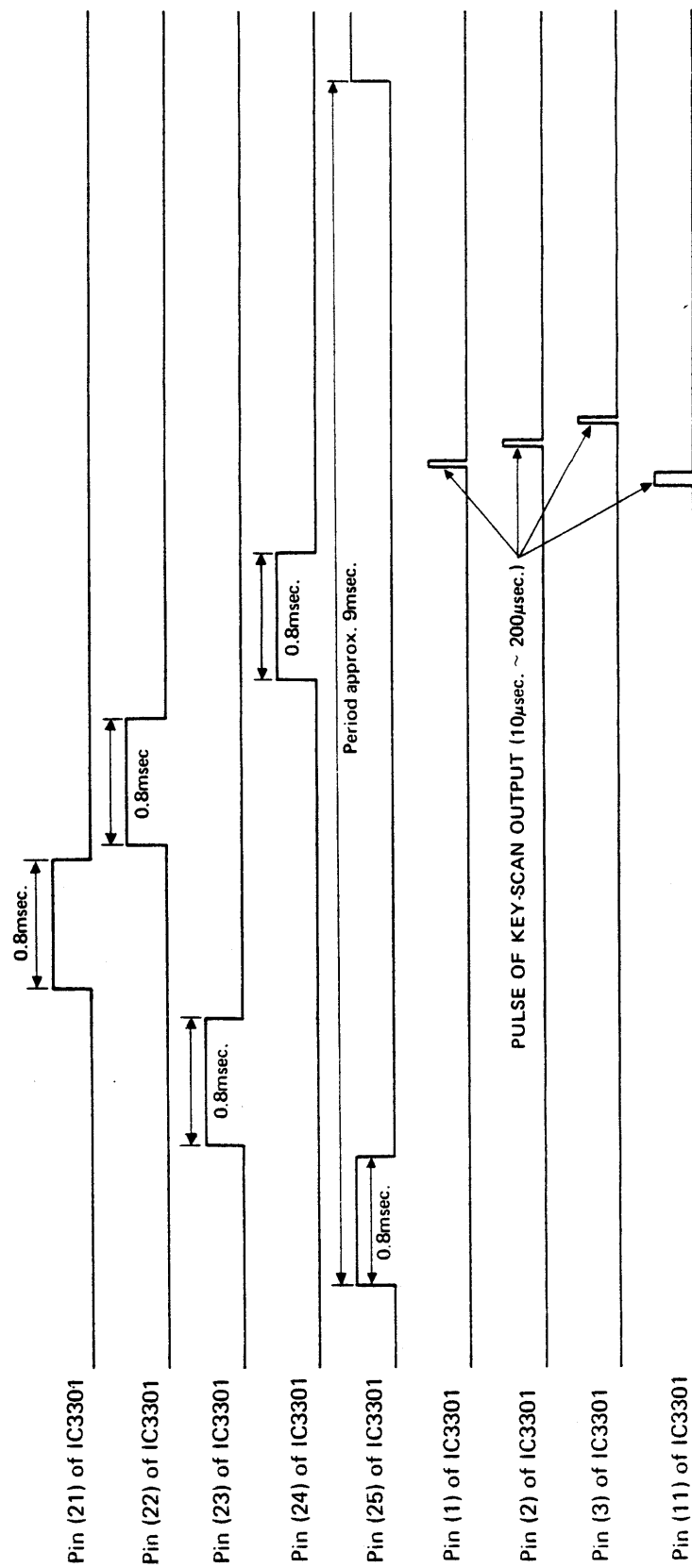


Fig. 2-5-4 Timing Chart of Key-Scan

c. Other output circuits.

The input/output signals to and from the system control circuit and the key input signals are shown in Fig. 2-5-5.

The output ports O_6 , R_8 , R_9 , and R_{10} are for key scan output signals, which are output at the timing shown in Fig. 2-5-4. There are switches at the points at which these outputs intersect the K_1 and K_2 input ports. When a switch is activated the scan signal mentioned above is input at a certain timing to K_1 or K_2 , and the microcomputer (IC3301) discriminates which switch has been activated.

The same principle is used for the key scan signals as for the $O_2 \sim O_5$ output signals and the fluorescent display illuminating signals. It is also used for determining the condition of the power switch (SW3302), generation of the REC signal, and discrimination of the COUNT UP/CONT DOWN signals. The count pulse signal, the MEMORY OUT signal, and the TIMER REC signal all correspond to K_8 , R_5 , R_6 , and to input and output ports on a one-to-one basis.

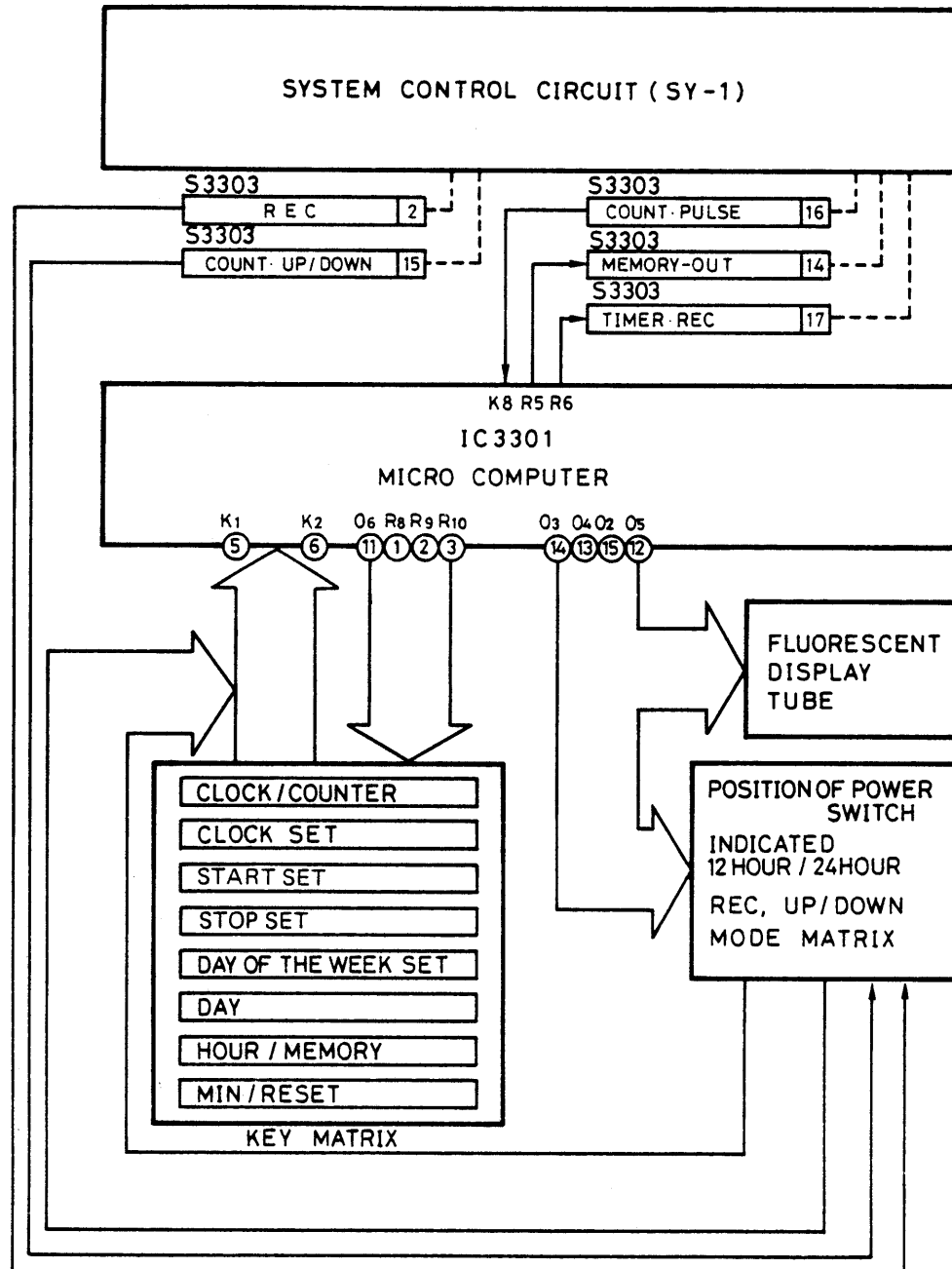


Fig. 2-5-5

The input/output voltage of the microcomputer (IC3301) are shown in Fig. 2-5-6.

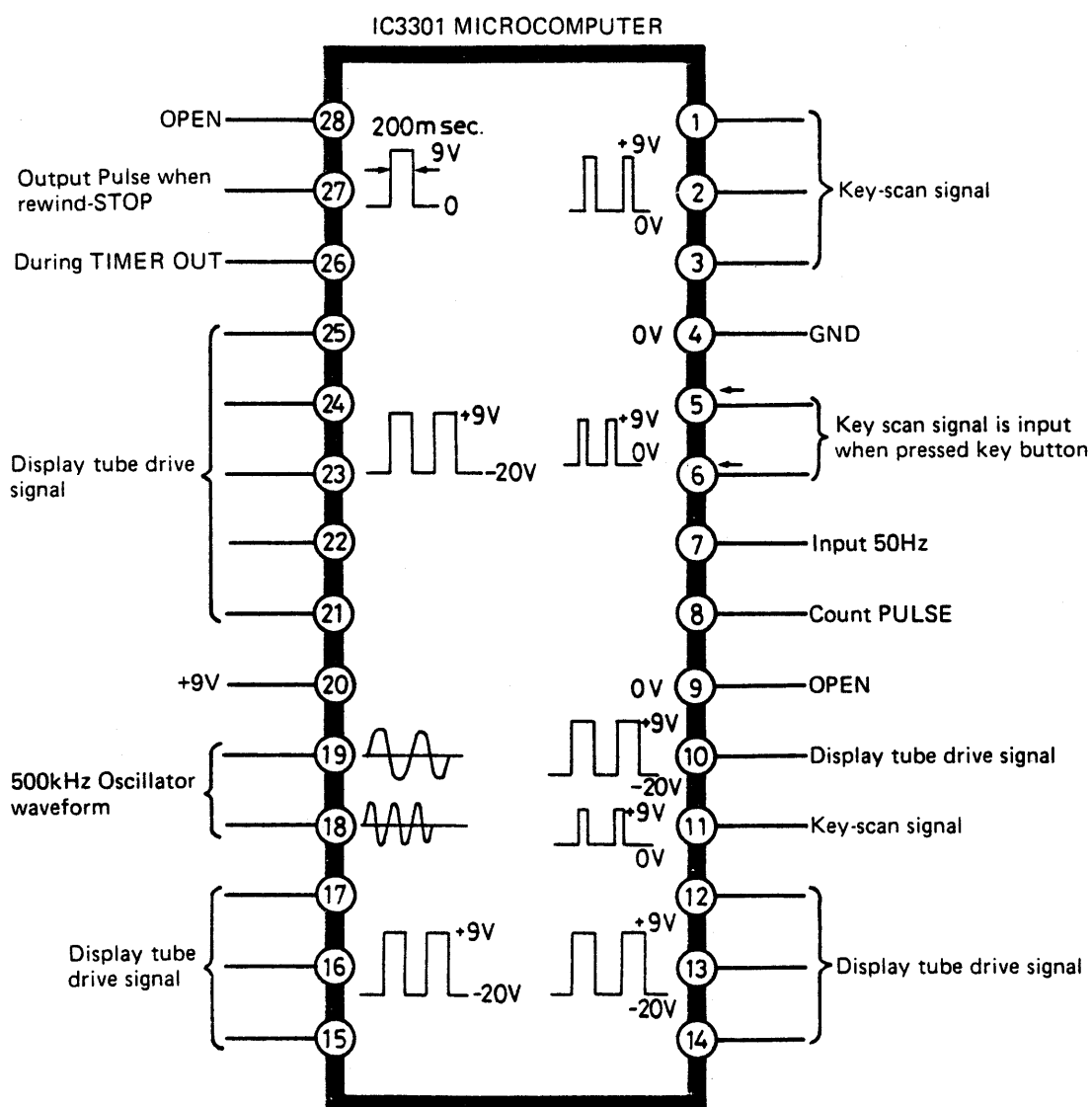
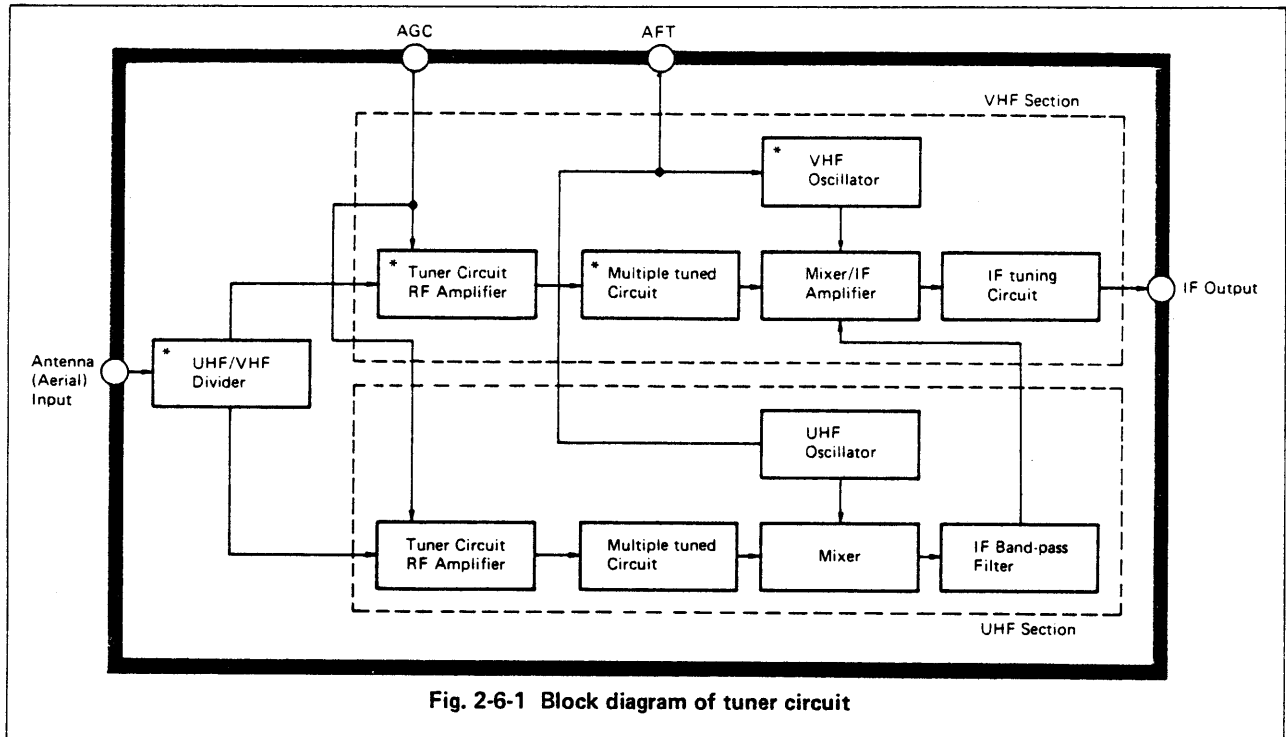


Fig. 2-5-6

F. TUNER CIRCUIT

1. TUNER CIRCUIT

The following explanation pertains to units equipped with a UHF/VHF combination tuner. In the case of only the UHF tuner the * symbol is omitted.



a. Antenna

The antenna employs a phono jack

b. UHF/VHF divider

The UHF/VHF divider employs a low-pass filter and a high-pass filter to divide the UHF and VHF signals.

c. VHF tuner circuit and RF amplifier

The VHF tuner circuit and the RF amplifier suppress all signals other than the desired channel signal and amplifies the desired channel signal. The AGC circuit is engaged by the signal strength and the output voltage is made uniform.

d. Multiple tuned circuit

The multiple tuned circuit has high selectivity characteristics and suppresses all signals other than the desired signal.

e. Oscillator circuit

The oscillator circuit generates the signal required for converting the desired signal into the IF signal.

f. Mixer/IF amplifier

This circuit functions as the VHF mixer and UHF IF

amplifier. When VHF signals are received, the output signal of the VHF oscillator and the channel signal being received are mixed and converted into the IF signal. When UHF signals are received, the circuit functions to amplify the signals which are converted into the IF signals.

g. IF tuning circuit

This is the single tuned circuit for the IF signal.

h. UHF section

The UHF section contains the following circuits just like the VHF section:

- (1) Tuned circuit/RF amplifier
- (2) Multiple tuned circuit
- (3) Oscillator
- (4) UHF mixer

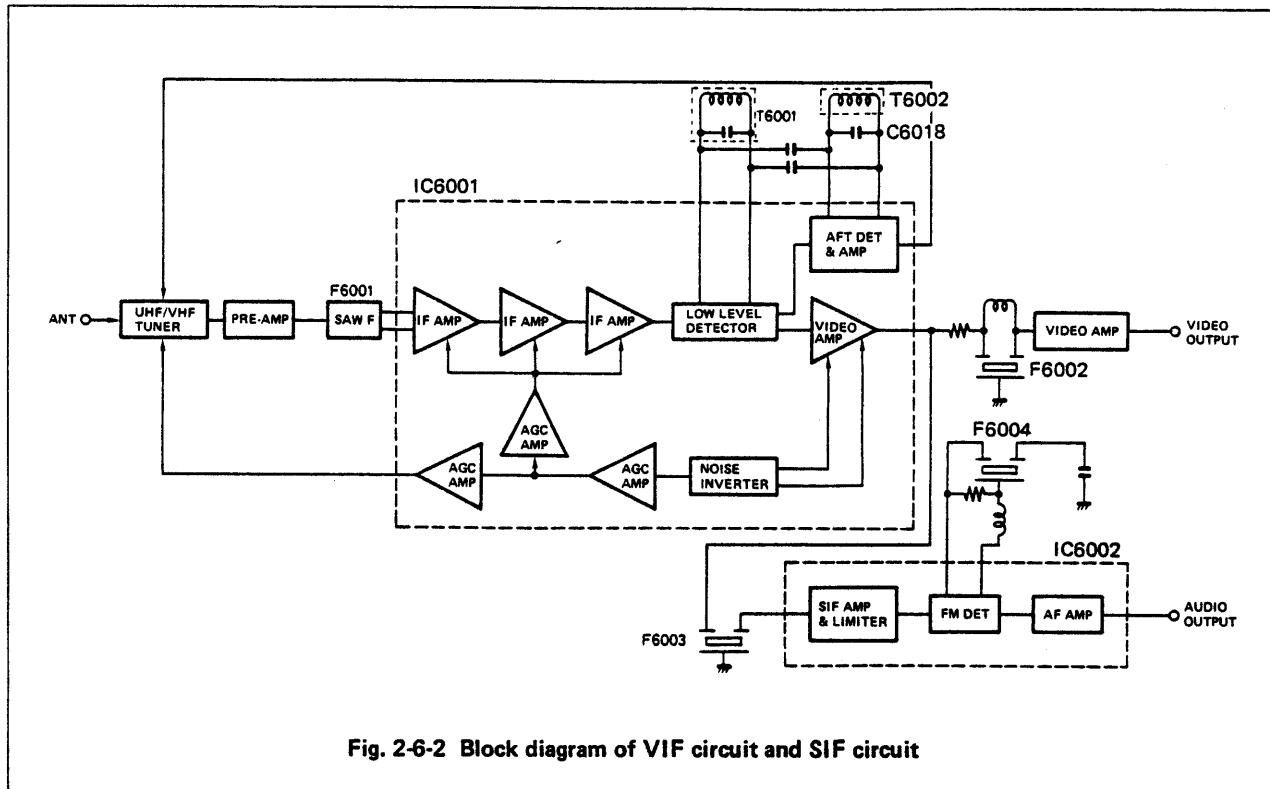
An IF bandpass filter with high selectivity characteristics is employed.

i. AFT

The AFT circuit maintains the IF output signal frequency at a constant level.

2. VIF CIRCUIT

The VIF circuit serves to obtain the required selectivity response and to amplify and video detect the VIF signal. (Refer to the block diagram in Fig. 2-6-2.)



a. Pre-amplifier

The required selectivity characteristics are produced by the surface acoustic wave filter (SAW F). The SAW filter also experiences a loss effect and, therefore, an amplifier is required to compensate for this loss. In order to improve the signal to noise ratio, an emitter-earthed single-stage amplifier (Q6001) is employed before the SAW filter.

b. VIF amplifier, video detector, AFT, and AGC

The VIF signal enters IC6001 from the SAW filter. This IC is composed of the VIF amplifier, the video detector,

the AFT circuit, and the AGC circuit. (Refer to Fig. 2-6-4.)

(1) VIF amplifier

The signal is amplified by this 3-stage variable gain IF amplifier.

(2) Video detector

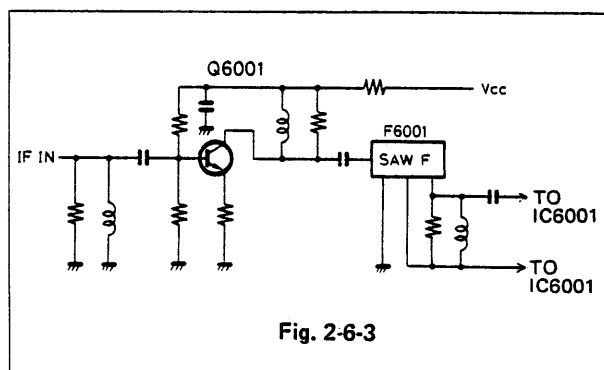
The amplified VIF signal is supplied to the tuning circuit composed of T6001, and sync detection is performed. The detected video signal is video amplified while its signal-to-noise ratio is simultaneously improved by the noise inverter circuit.

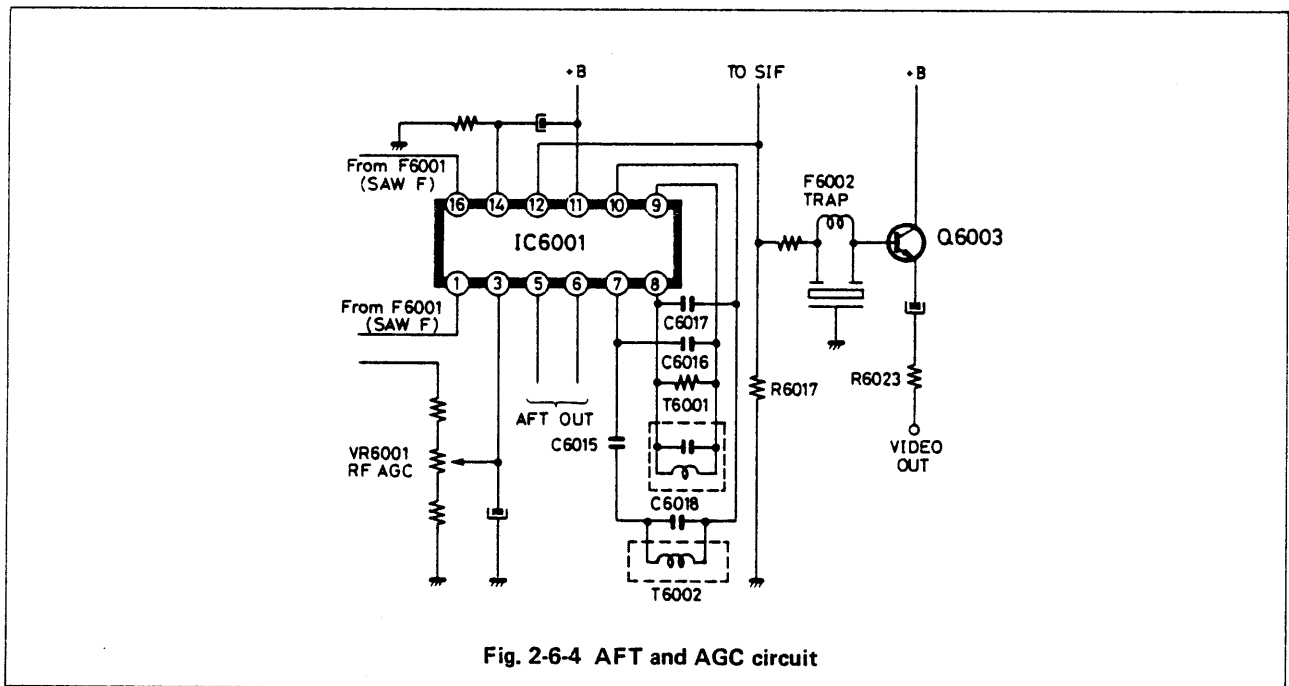
(3) AFT circuit

This circuit is composed of T6002 and C6018, and includes a phase shifter. The carrier output of the sync detector is connected to the phase shifter and the phase is detected, and therefore, a DC voltage which is proportional to the VIF carrier is obtained.

(4) AGC circuit

The AGC circuit is required to maintain the video output at a constant level in respect to fluctuations in the antenna input voltage. The control takes the form of a peak AGC system. The synchronizing signal level of the video





signal is detected, and the gain of the VIF amplifier circuit is varied, so that the level is maintained at a fixed value. The AGC voltage is also supplied to the U/V tuner's RF amplifiers of the UHF/VHF tuner, and the gain is varied (RF AGC-reverse AGC). When the antenna input voltage is low, the RF AGC action ceases and the RF amplifier functions at maximum gain. Once the input voltage exceeds approximately 65 dB μ , VR6001 is set so that operation begins.

c. Video amplifier circuit

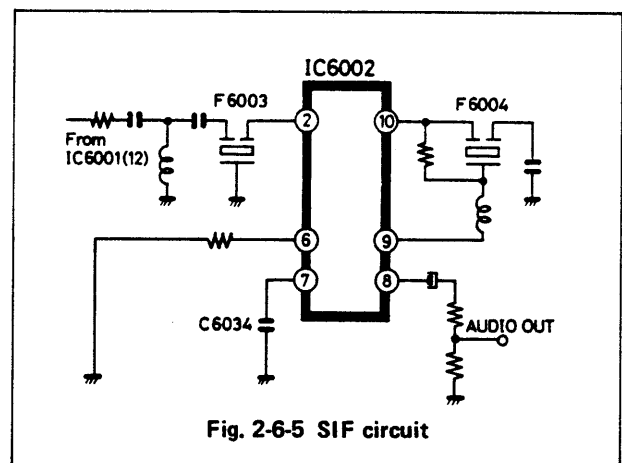
The level of the video signal detected by IC6001 is set by R6023 so that a 1 Vp-p output is obtained at the video output connector (75-ohm termination). The SIF signal contained in the video signal is eliminated by the ceramic trap F6002. Because the level of the video signal detected by IC6001 in the vicinity of the chrominance signal (4.43 MHz) is attenuated.

Finally, the impedance is reduced by the emitter follower and R6023 is applied to set the output impedance to 75 ohms.

3. SIF CIRCUIT

The SIF signal which is contained in the video signal detected by IC6001 is removed by the ceramic filter F6003 and supplied to IC6002. IC6002 is composed of an amplitude-limiter circuit and an FM detector circuit. The SIF signal has its AM component removed by the amplitude-limiter circuit. The signal is then fed into the differential peak detector circuit, and the sound signal is produced.

The sound signal, which has undergone pre-emphasis at the transmission end, now undergoes de-emphasis by



C6034 and the internal impedance, and the frequency response is smoothed. The audio output level is adjusted by R6036 and R6037.

4. MUTING CIRCUIT

In the playback mode, both the video signal and the audio signal from the tuner circuit are designed to develop no output in order to prevent interference between the playback signal and the demodulated tuner signal. For this purpose, a voltage forcibly applied to IC6001 at pin (14) increases the AGC voltage for the IF amplifier, which then mutes the video signal output and the SIF signal output.

5. Varactor tuning operation

The tuner circuit varies between the countries where the VCR is being used. Please refer to the wiring diagram before applying the description.

1. Channel selector circuit composition

This VCR utilizes an electronic tuner whose channel selector circuit comprises the TN-2 circuit board (channel selector VR circuit and channel selector SW circuit).

2. TN-2 circuit board

- a. This circuit presets the desired broadcast station by the selector variable resistor mounted on the printed circuit board.
When presetting the desired broadcast station, the dial of the selector variable resistor is turned until the desired broadcast station is received.
- b. This circuit indicates the selected broadcast station by the selector switch mounted on the printed circuit board.
- c. AFT defeat circuit for preventing AFT misoperation. In AFT operation this circuit momentarily shuts off the AFT during channel change to prevent AFT misoperation.

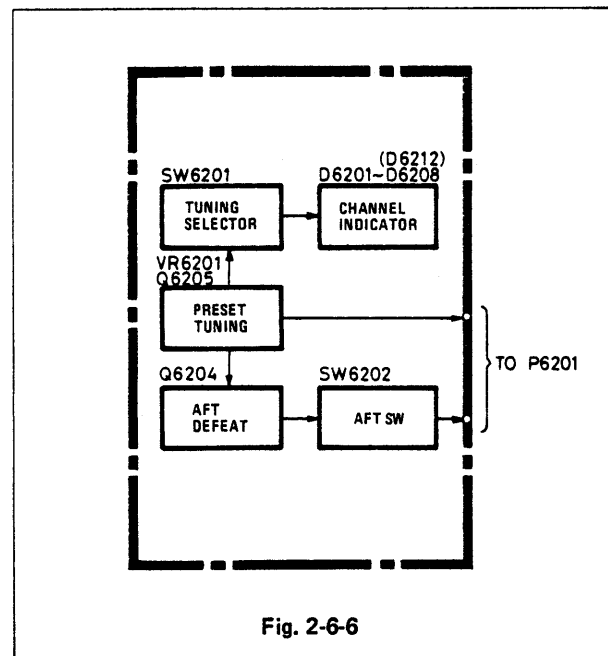


Fig. 2-6-6

G. POWER SUPPLY CIRCUIT

1. Outline

The power supply circuit is composed of the PW-1 assembly, PW-2 assembly, and a power transformer. The block diagram is shown in Fig. 2-7-1, and the output voltages and the supply destination chart is shown in Table 2-7-1.

The output conditions include a continuous output (timer power supply, etc.) whether the power switch is on or off but when the AC plug is connected to a power source and a voltage ON-OFF controlled by the power switch and timer output.

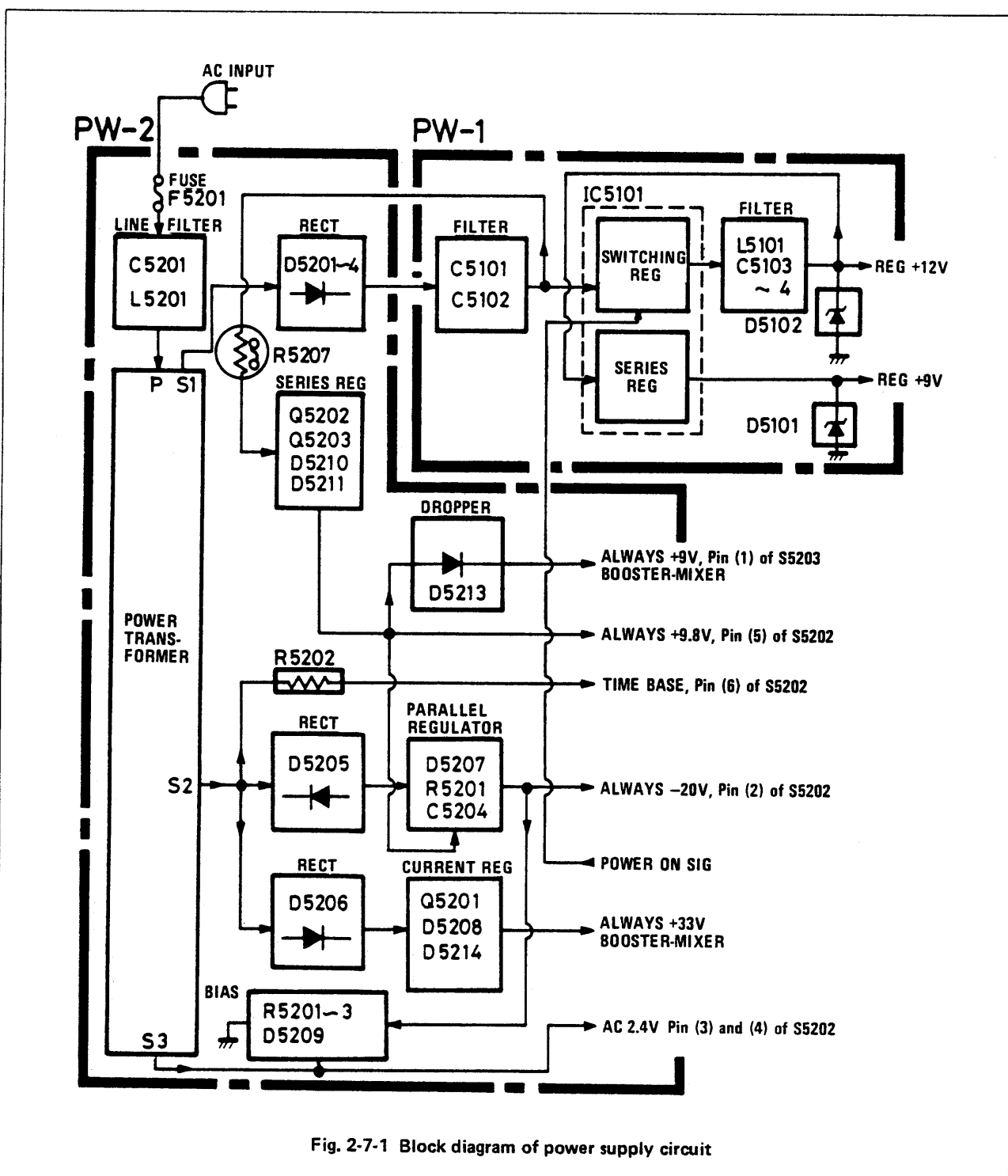


Fig. 2-7-1 Block diagram of power supply circuit

Output whether the power switch is on or off		Output only when the power switch is on	
Output voltage	Supply voltage	Output voltage	Supply voltage
DC +33V	TUNER (TN-2)	DC +12V	TUNER (TN-1)
DC +9.0V	BOOSTER MIXER		SERVO (SV-1)
DC +9.8V	TIMER (SY-2)		SYS. CONT.(SY-1)
DC −20V			RF CONV (VD-1)
*AC 2.4V		DC +9V	VIDEO (VD-1)
*TIME BASE			VIDEO (VP-1)
*Outputs other than these are all stabilized power supplies.			AUDIO (VD-1)

Table 2-7-1 Power supply destinations and voltage

2. Continuous output power supply

The continuous power supply is mainly composed on the PW-2 circuit board and outputs DC +9.8 V, DC -20 V, AC 2.4 V, and the time base voltage for the timer and DC 9 V and DC 33 V for the booster mixer and tuner circuit.

a. DC 9.8 V circuit

The output of the S1 secondary coil of the power transformer passes through the bridge rectifier circuit made up of D5201 ~ 4 of circuit board PW-2 and the filter made up of C5201 ~ 2 of circuit board PW-1, enters the series regulator circuit made up of Q5202 ~ 03 and D5210 ~ 11, etc. of circuit board PW-2, and outputs DC 9.8 V.

b. DC 9 V circuit

DC 9 V is obtained from the DC 9.8 V in the previous section by a dropping resistor composed of a silicon diode (D5213).

c. DC 33 V, DC -20 V and the timer base voltage circuit
The output of the S2 secondary coil of the power transformer is rectified by the half-wave rectifier circuit made up of D5205 and C5202 and by that made up of D5206 and C5203, and about DC ± 43 V appears in each condenser.

A +33 V is output from C5203 and then passes through the constant current circuit made up of Q5201, D5214, D5208, etc. to the tuner circuit.

A negative DC -20 V is output from C5202 and then passes through the parallel constant voltage circuit made up of R5201, D5207, etc. to the timer circuit. Also, the time base voltage is output from S2 of the power transformer and passes through R5202.

As shown in Fig. 2-7-2, each of the above outputs is designed so that the common side of the circuits is biased to DC 9.8 V and so that voltages from earth become each value in the figure.

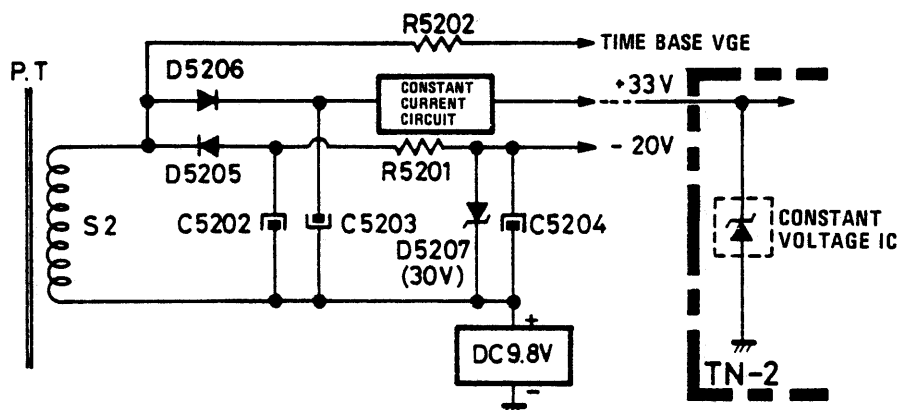


Fig. 2-7-2 Power supply circuit (PW-2) for timer and tuner circuits

d. AC 2.4 V circuit

As shown in Fig. 2-7-3, the AC 2.4 V necessary for the filament in the fluorescent display tube of the timer circuit is directly supplied from the S3 secondary coil in the power transformer. However, as shown in the diagram, the circuit is constructed so that it is biased to about -14 V by R5211 $\sim$ 13 and D5209 (5.6 V) and so that the voltage between the anode and cathode necessary for the display tube is obtained.

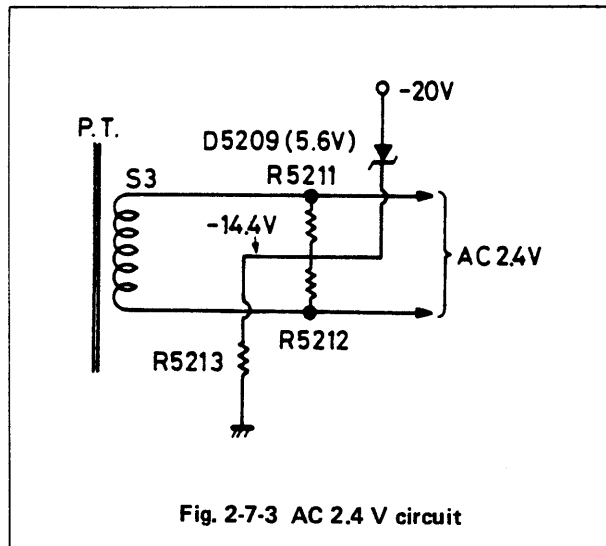


Fig. 2-7-3 AC 2.4 V circuit

3. Power supply output with the power switch ON

So that a stable DC 12 V and 9 V is supplied to both control circuits of the servo system control, the tuner, the RF converter circuit, and the video and audio circuits, the IC5101 regulator IC on the PW-1 circuit board is utilized. Moreover, if there should be damaged IC in any one of the output terminals, a protection circuit has been provided to prevent excess voltage from being impressed on the load side, and an excess current protection function is also provided to protect power supply parts if there should be a short circuit.

a. IC5101

The constant voltage IC5101 (STK7216) is a hybrid IC with a +12 V fixed output frequency fixed pulse modulation system step-down type switching regulator and a +9 V fixed output series regulator built in. Its block diagram is shown in Fig. 2-7-4.

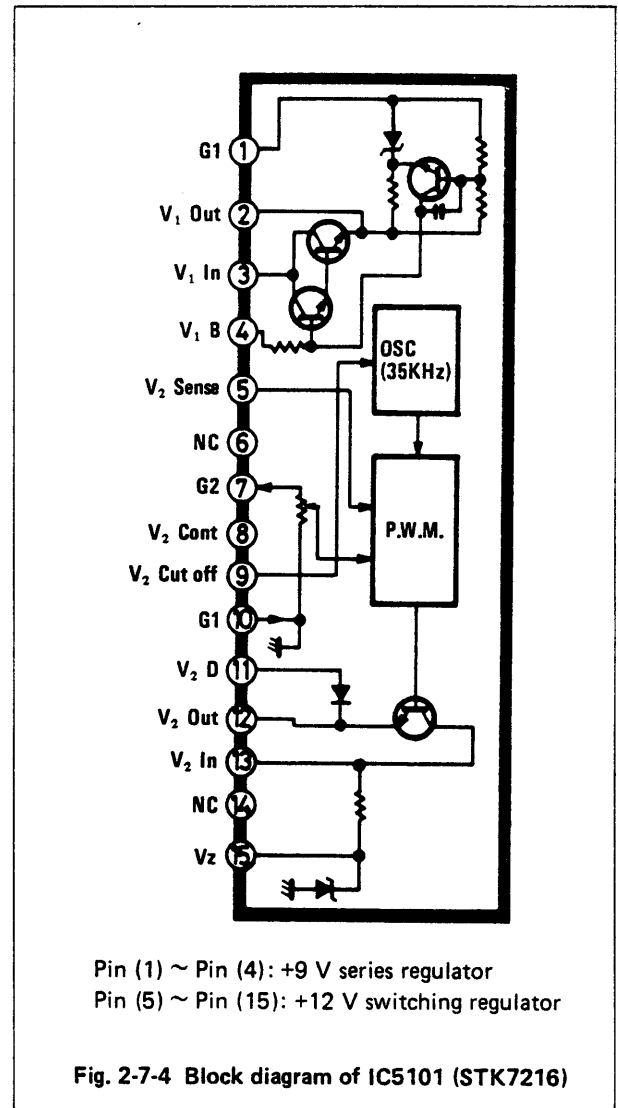
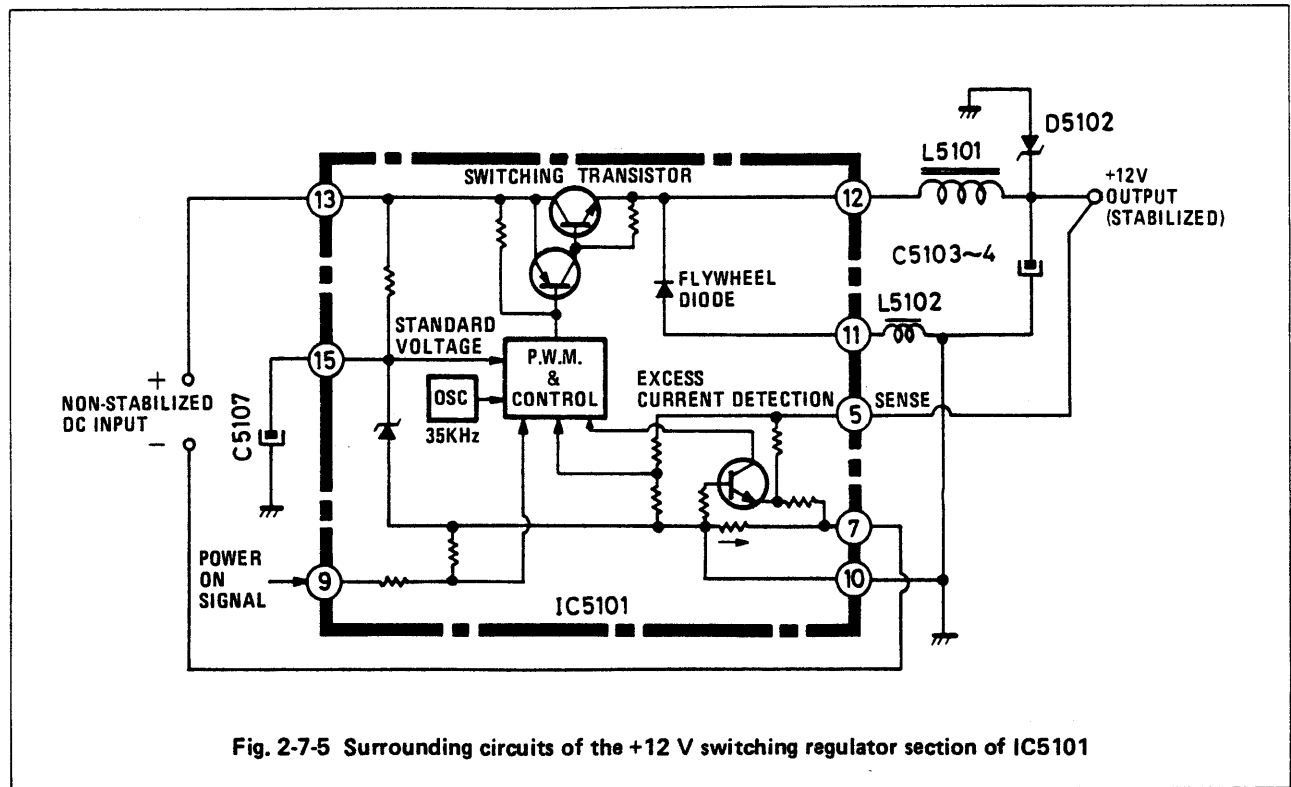


Fig. 2-7-4 Block diagram of IC5101 (STK7216)

b. DC +12 V output circuit

The important points of the +12 V switching regulator are shown in Fig. 2-7-5. Its basic operation is the same as previous models so its description will be omitted here.

D5102 is an excess voltage prevention diode, and in case there is a malfunction in the power supply section, it protects so that there are no excess voltages in the load.



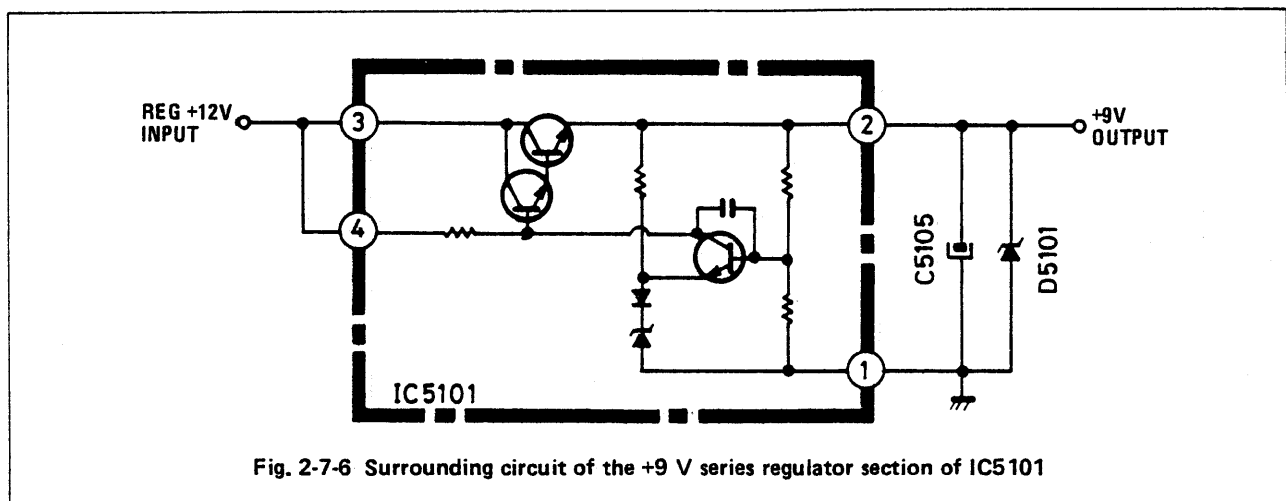
c. DC +9 V output circuit

Fig. 2-7-6 shows the circuit diagram for the 9 V series regulator section. Input pins (3) and (4) are directly connected to the +12 V output terminal mentioned in the previous section, and if they should be short circuited with the 9 V output terminal, the protection circuit for the 12 V circuit operates. Also, D5101 is a Zener diode which prevents excessive voltages in the load.

d. Operation of the power switch

When pin (9) of IC5101 is made HIGH level, the switching transistor of the 12 V switching regulator circuit operates and +12 V is output. Hence, +9 V is also output.

In this model, the +12 V and +9 V output is controlled when the power switch is on and by choosing the HIGH level for the TIMER REC (including SLEEP) ON signal and connecting it to pin (9).



III. MECHANISM DESCRIPTION

A. FEATURES

1. MECHANISM CHASSIS

The chassis which forms the base for the mechanism is constructed as follows:

(1) Main chassis

*Glass fiber reinforced plastic.

This chassis is mainly for mounting the reel drive system, the loading drive system, the pinch roller presser system, and the eject mechanism.

(2) Drum chassis

*Die-cast aluminium.

This chassis is mainly for mounting the tape path system, the video head drum, and the back tension mechanism.

2. MOTORS STRUCTURE

The motors which drive the mechanism consist of the following:

(1) Head motor

*Brushless DC motor.

*Direct drive (D.D.) type system in the video head drum.

(2) Capstan motor

*Brushless DC motor.

*Capstan-integrated direct drive (D.D.) system.

(3) Reel motor

*DC motor.

*Reel bases driven through a system of belts, gears, and idlers.

(4) Loading motor

*DC motor.

*Loading ring drive.

Mode \ Parts	Video Head Motor	Capstan Motor	Reel Motor	Loading Motor	Reel Base Speed
STOP	OFF	OFF	OFF	OFF	————
LOADING	ON	OFF	OFF	ON CCW	————
UNLOADING	ON	OFF	ON CW	ON CW	LOW
REC	ON	ON CCW	ON CW	OFF	LOW
PLAY	ON	ON CCW	ON CW	OFF	LOW
PAUSE	ON	OFF	ON CW	OFF	LOW
STILL	ON	OFF	ON CW	OFF	LOW
F-SEARCH	ON	ON CCW	ON CW	OFF	LOW
R-SEARCH	ON	ON CW	ON CCW	OFF	LOW
F FWD	OFF	OFF	ON CW	OFF	HIGH
REW	OFF	OFF	ON CCW	OFF	HIGH

CW: Clockwise CCW: Counter clockwise

Fig. 3-1-1

3. MECHANISM OPERATION

A motor logic control system is used to combine the operation of the loading motor, the reel motor, and the capstan motor in order to perform the mechanism switching required in each of the various modes.

(1) The switching of the play gear and the F FWD/REW roller to the supply reel base or the take-up reel base during reel base drive is performed by the rotation force and rotation direction of the reel motor.

(2) The speed reduction ratio for reel base drive and the switching between slip drive and direct drive is performed by the mode select slide, which moves back and forth in accordance with the rotation of the loading ring.

(3) The pinch roller is pressed against the capstan by a cam on the circumference of the loading ring.

(4) Cassette ejection is possible in the STOP mode only. The mechanism is designed so that ejection cannot be performed in any other mode.

The mechanism operation chart for the various VCR modes is shown in Fig. 3-1-1.

B. SAFETY DEVICES

1. TAPE-END DETECTION DEVICES (See Fig. 3-2-1.)

Video cassette tape has a section of nonmagnetic trailer tape at both ends of the magnetic recording tape. The tape end is detected when the FWD sensor or the REW sensor detects this trailer tape. When either the FWD sensor (1) or the REW sensor (2) detects the trailer tape, the loading motor (3) rotates in the counter clockwise direction, and this rotation force is transmitted to the loading ring (6) through the loading motor belt (4) and the loading gear assembly (5).

As a result, the loading ring (6) rotates in the clockwise direction so that the VCR enters the UNLOADING mode; then, at the completion of unloading, it enters the STOP mode. In this way, the tape is protected from excessive stress.

Note: The rewind sensor in models produced in and after July, 1982 will be modified.

(Refer to item "VII-D-11 REW SENSOR")

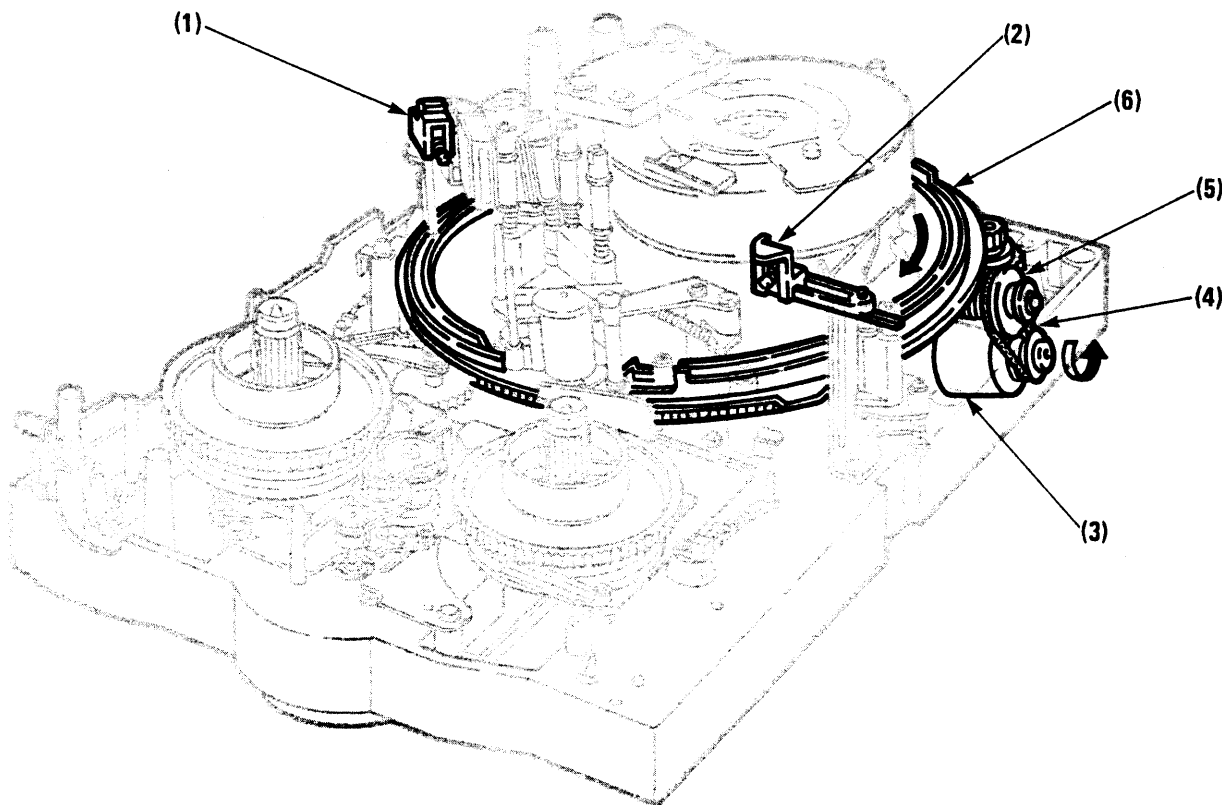


Fig. 3-2-1

2. DEW SENSOR (See Fig. 3-2-2.)

If the ambient temperature or humidity changes suddenly, condensation (dew) may form on the surface of the video head drum. If this occurs, the DEW sensor (7) will detect the condensation and cause the VCR to enter the STOP mode in order to protect both the tape and the mechanism from damage. If the DEW sensor functions to set the VCR to the STOP mode, the dew LED will illuminate, and the only operation that will be possible is cassette ejection.

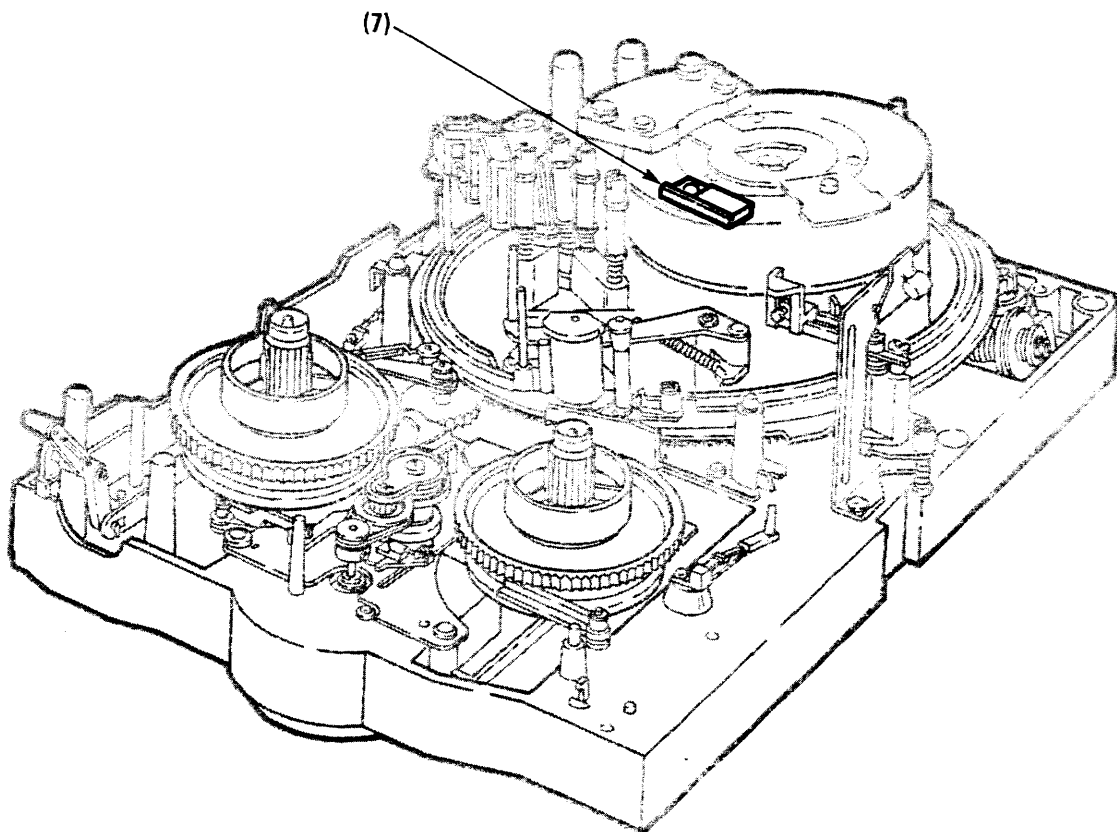


Fig. 3-2-2

3. TAKE-UP REEL BASE ROTATION SENSOR

(See Figs. 3-2-3 ~ 3-2-6.)

In any mode in which tape transport is done, in the event that the take-up reel base (10) stops due to a reel motor (8) malfunction or a broken reel motor belt (9), the resulting slackness will damage the tape.

In order to prevent such damage, a detection system is provided to detect the rotation of the take-up reel base. While the take-up reel base (10) is rotating, a notch on the reel base is detected by a photo sensor (11) to provide a pulse signal. If the take-up reel base (10) stops rotating, the pulse signal will no longer be obtained, thus indicating that the reel base has stopped. (See Fig. 3-2-3.)

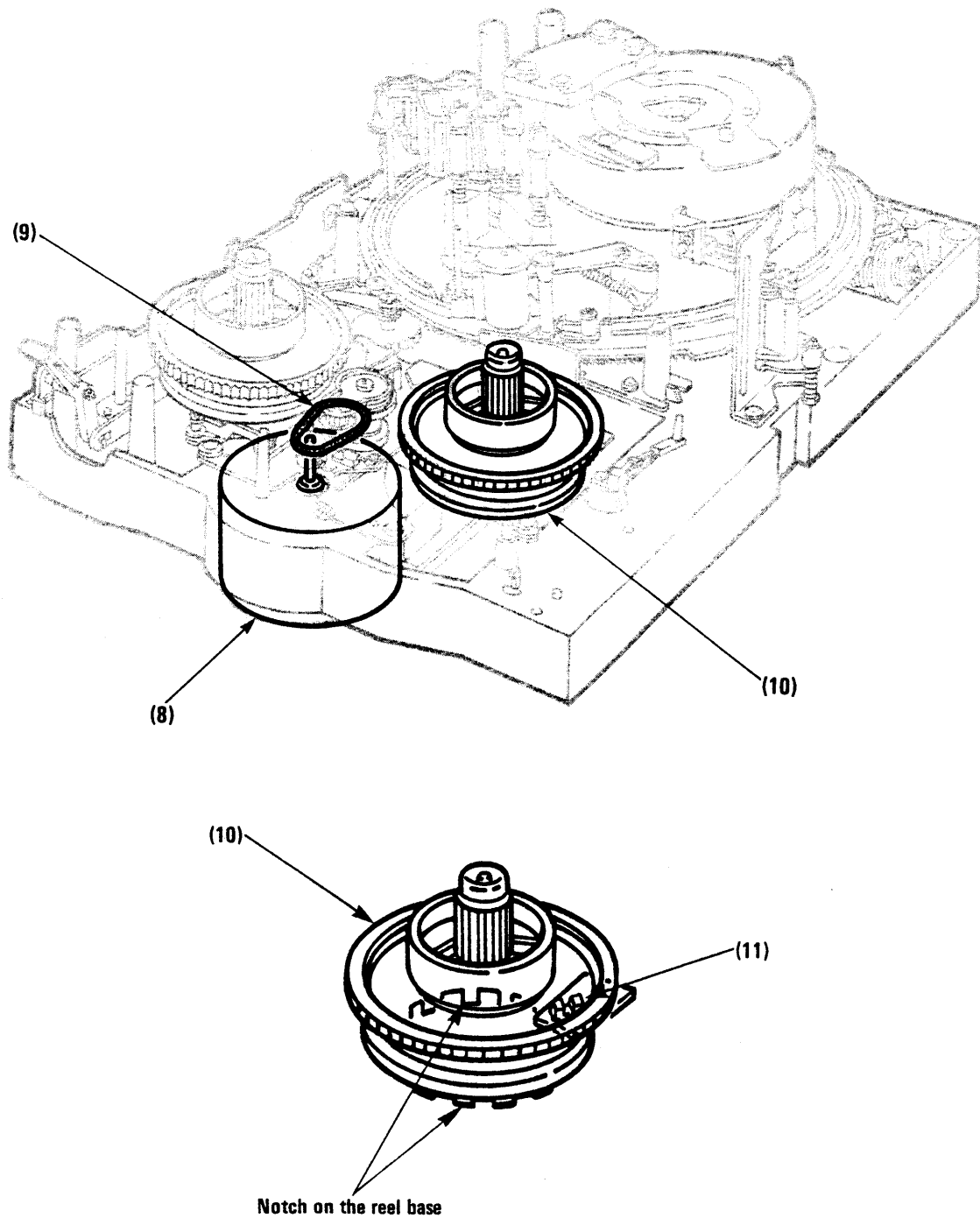


Fig. 3-2-3

If the take-up reel base rotation sensor detects that the reel base has stopped during any of the PLAY, REC, F-SEARCH, or R-SEARCH modes, the capstan motor (12), the reel motor (8), and the video head will stop. (See Fig. 3-2-4.)

If the sensor detects that the reel base has stopped during any of the F FWD, REW, or UNLOADING modes, the reel motor (8) will stop, and the loading motor (3) will rotate in the clockwise direction. The loading ring (6) will then rotate in the counter clockwise direction and, once loading is completed, the VCR will enter the STOP mode. (See Fig. 3-2-5.)

If the sensor detects that the reel base has stopped during the LOADING mode, the loading motor (3) will rotate in the counter clockwise direction and the loading ring (6) will rotate in the clockwise direction to perform unloading. Then, once unloading is completed, the VCR will enter the STOP mode. (see Fig. 3-2-6.)

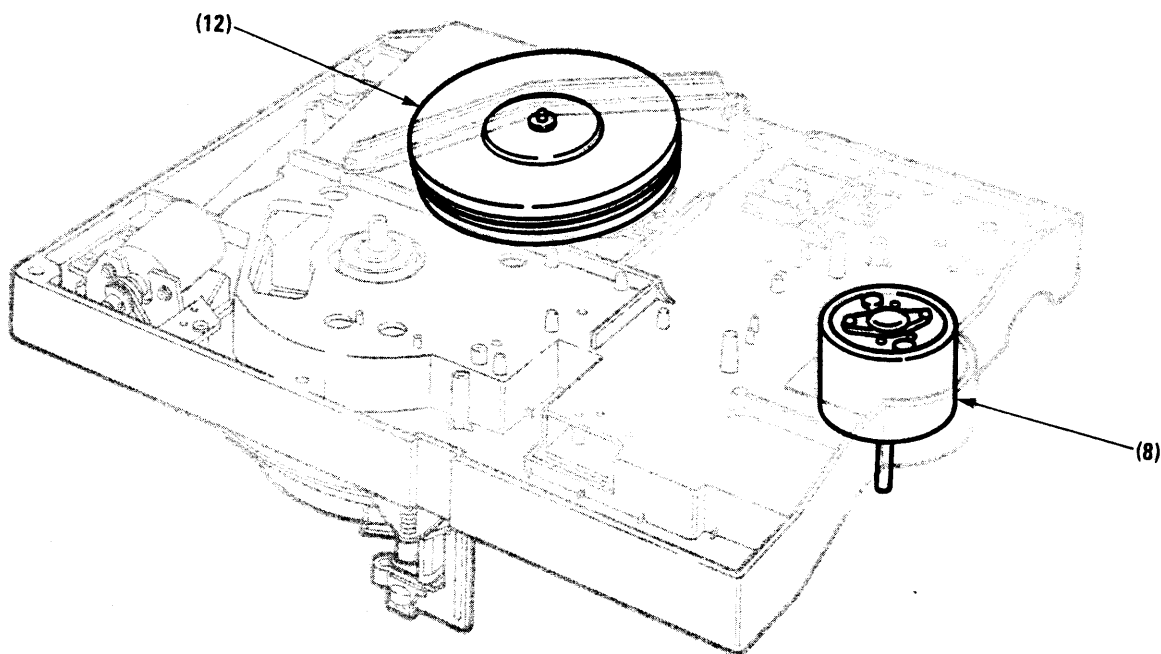


Fig. 3-2-4

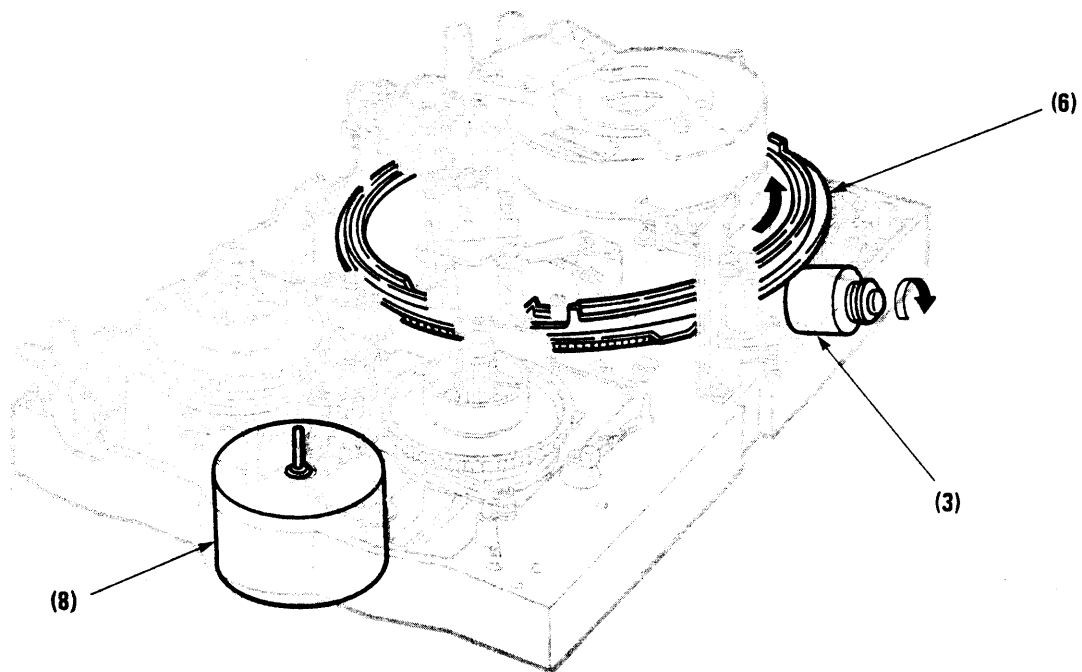


Fig. 3-2-5

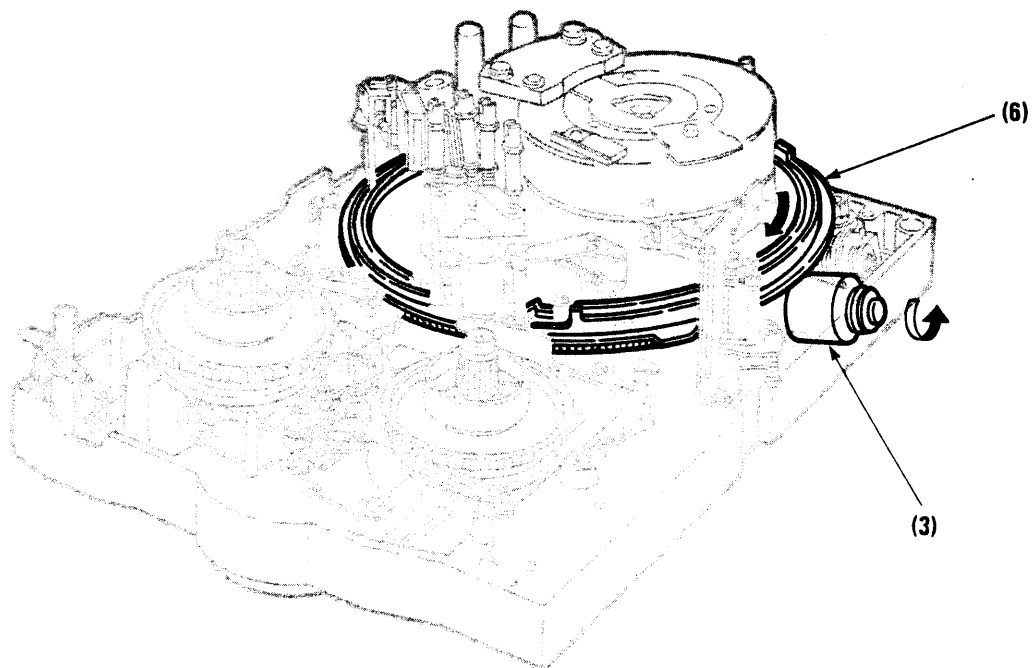


Fig. 3-2-6

4. PAUSE/STILL AUTOMATIC CANCELLATION DEVICE

(See Fig. 3-2-7.)

If the video head drum continues to rotate for long periods while the tape is not moving, the video heads will be prematurely worn, and their useful life will be shortened. In order to prevent this from occurring, if any of the PAUSE, STILL, or STOP-PAUSE modes continues for more than five minutes, the loading motor (3) will rotate in the counter clockwise direction and the loading ring (6) will rotate in the clockwise direction to perform unloading. Then, once unloading is completed, the VCR will enter the STOP mode.

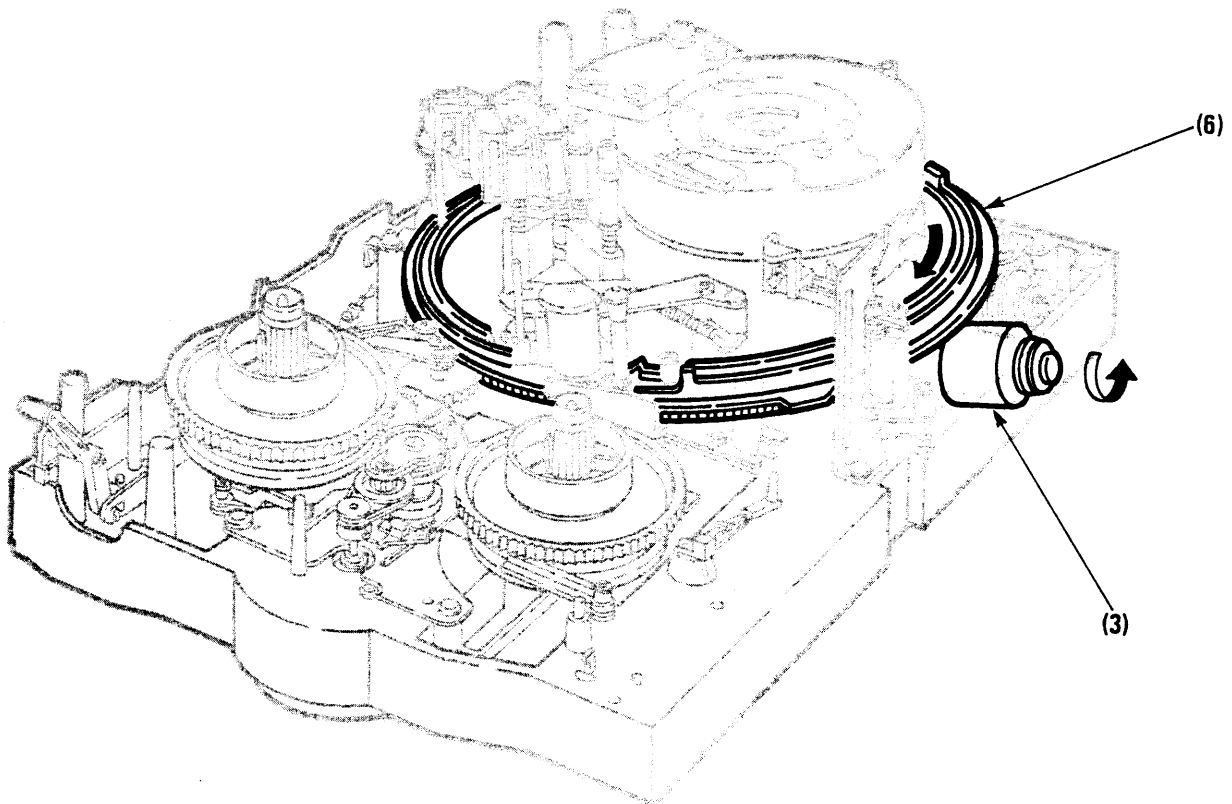


Fig. 3-2-7

C. MECHANISM OPERATION IN EACH MODE

1. FROM CASSETTE INSERTION TO THE STOP MODE

(See Figs. 3-3-1 ~ 3-3-3.)

If the power is turned on [if the power switch is set to the "ON" position] and a video cassette is inserted into the cassette holder, the lock on the cassette tape lid is released by the tab (A) in the cassette holder. (See Fig. 3-3-1.)

When the cassette holder is pressed down into the VCR, the cassette tape lid is opened by the tape lid guide (13). As the cassette moves downward, the cassette detection slide (14) is pressed down, and, at the same time that the cassette holder is locked down by the cassette holder lock lever (15), the cassette-in switch (16) is turned on by the cassette detection slide (14), thus setting the VCR to the STOP mode. (See Figs. 3-3-2, 3-3-3.)

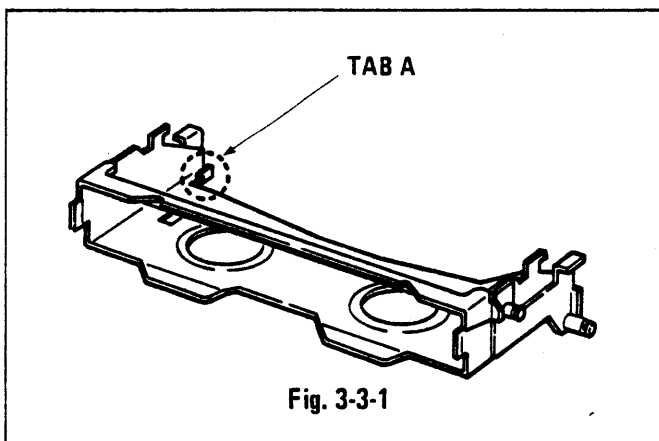


Fig. 3-3-1

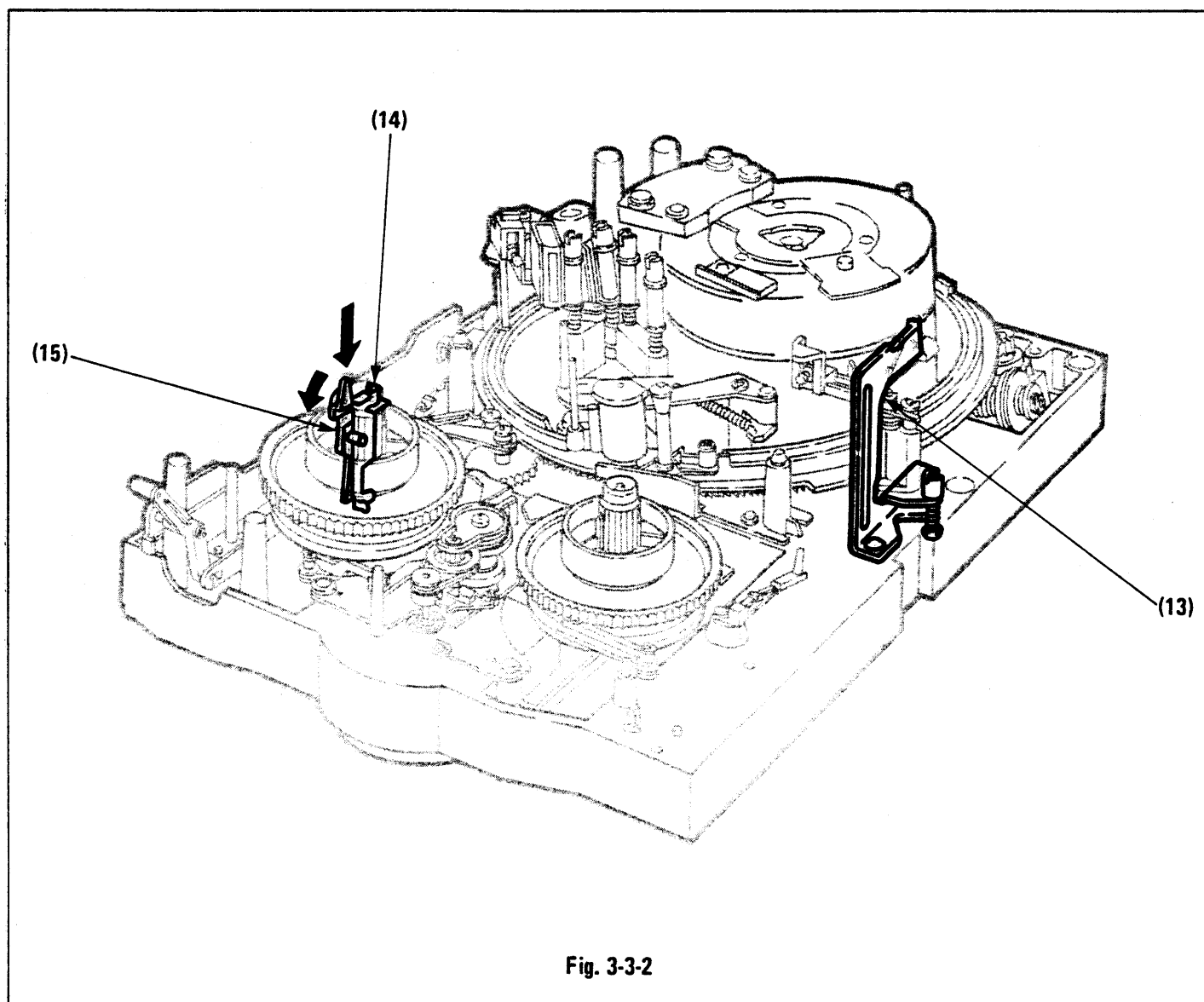


Fig. 3-3-2

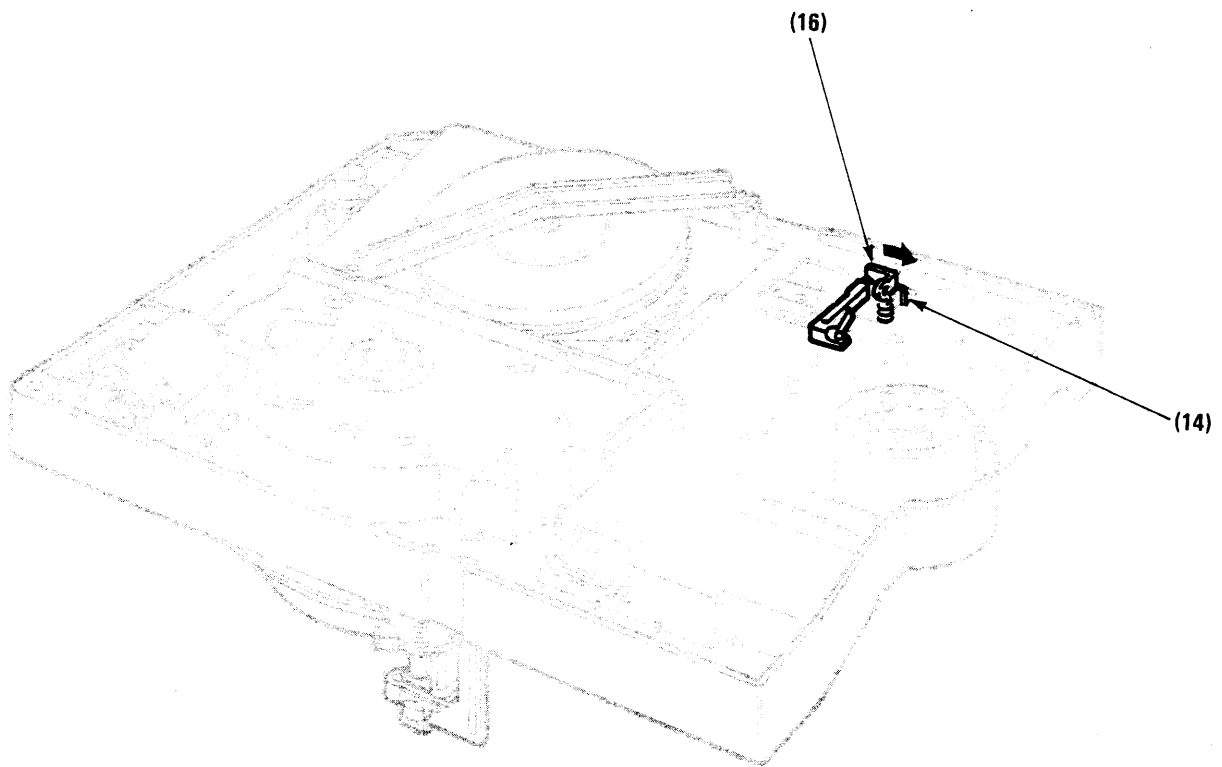


Fig. 3-3-3

2. DRIVE PATH AND SWITCHING DIRECTION OF THE REEL BASE DRIVE IN EACH MODE

Before giving an explanation of the operation in each mode, the reel base drive and switching will be explained below:

There are two methods for tape transport. In both, the tape is driven at a constant speed by the capstan; however, in the first, the tape is wound at the reel base through the slip mechanism, and, in the second, the tape is wound directly at the reel base, without passing through the slip mechanism. If tape winding is further divided into the supply reel and the take-up reel, this results in four types of reel base drive.

(Drive Path 1 See Fig. 3-3-4.)

Drive of the take-up reel base through the slip mechanism; used in the REC, PLAY, and F-SEARCH modes.

(Drive Path 2 See Fig. 3-3-5.)

Drive of the supply reel base through the slip mechanism; used in the R-SEARCH mode.

(Drive Path 3 See Fig. 3-3-6.)

Direct drive of the take-up reel base; used in the F FWD and UNLOADING mode.

(Drive Path 4 See Fig. 3-3-7.)

Direct drive of the supply reel base; used in the REW mode.

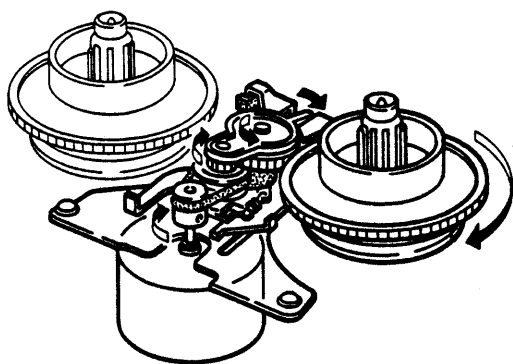


Fig. 3-3-4 Drive Path 1

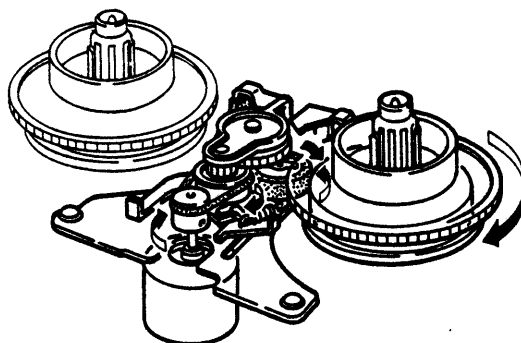


Fig. 3-3-6 Drive Path 3

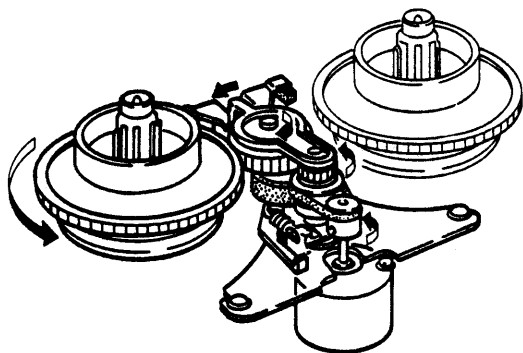


Fig. 3-3-5 Drive Path 2

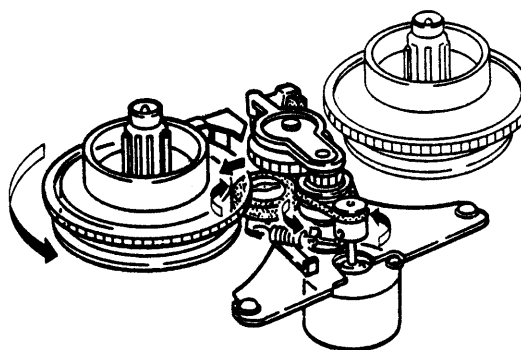


Fig. 3-3-7 Drive Path 4

Next will be given an explanation of reel base drive structure and operation:

[Structure] (See Figs. 3-3-8, 3-3-9.)

The mode select lever (17) uses a boss projecting from the main chassis as an axis. One end is in contact with the cam (B) on the circumference of the loading ring, and the other end with the mode select slide (18). The tension of the mode select spring (19) keeps the lever constantly pressed against

the circumference of the loading ring. Therefore, the mode select lever (17) swings because of the cam on the circumference of the loading ring and moves the mode select slide (18) back and forth in the direction indicated by the arrow. Also, the supply reel brake (20) and the take-up reel brake (21) are located on either end of the mode select slide (18), and the brakes are applied to the respective reel bases by the pulling force of the mode select spring (19). (See Fig. 3-3-8.)

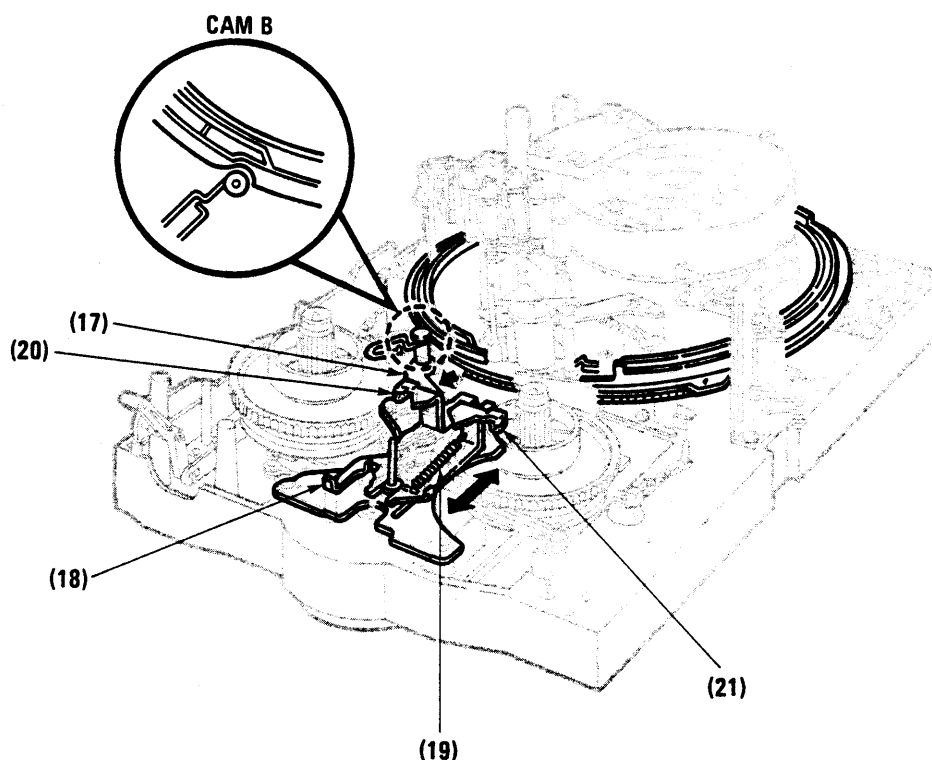


Fig. 3-3-8

The reel drive idler is a two-level structure, upper and lower. The upper is the play gear (22) (used for REC, PLAY, F-SEARCH, and R-SEARCH modes), and the lower is the F FWD/REW roller (23) (used for F FWD and REW modes). Corresponding to this, the supply reel base and the take-up reel base are also two-level structures, upper and lower. The upper gears are driven for slip drive, and the lower ones for direct drive. The play gear (22) is mounted to the play lever (24), and the F FWD/REW roller (23) is mounted to the F FWD/REW lever (25).

Also, the play lever (24) and the F FWD/REW lever (25) are, together with the center gear (26), mounted onto a shaft (28) fixed to the base plate (27). The center gear (26) is connected to the reel motor pulley (29) by the reel motor belt (9), and transfers the rotation force of the reel motor (8) to the play gear (22) and the F FWD/REW roller (23). (See Fig. 3-3-9.)

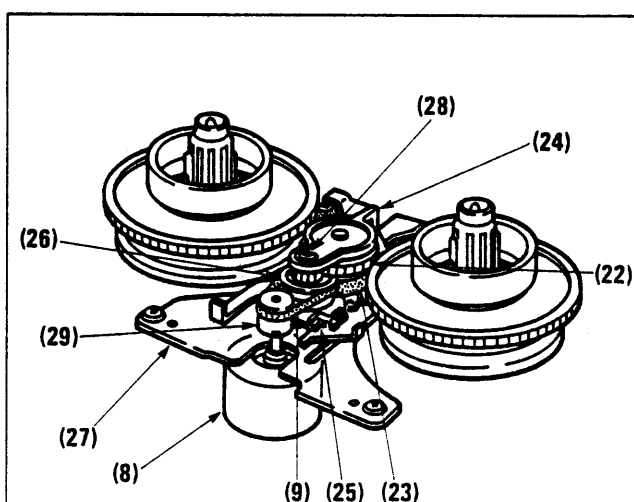


Fig. 3-3-9

[Operation] (See Figs. 3-3-10 ~ 3-3-13.)

Fig. 3-3-10 shows the condition at the completion of loading. In this condition, both the supply reel brake (2) and the take-up reel brake (21) are disengaged. If, at this time, the reel motor (8) rotates in the clockwise direction as shown in Fig. 3-3-11, the center gear (26) will rotate in the clockwise direction. This rotation force will then cause the play lever (24) to swing in the direction indicated by the arrow, and the play gear (22) will mesh with the take-up reel gear (30). In

the same way, if the rotation direction of the reel motor (8) is reversed, the play gear (22) will mesh with the supply reel gear (31). At the completion of loading, the play gear (22) meshes with the upper gear on either the supply reel base (32) or the take-up reel base (10), and slip drive will begin. At this time, because the F FWD/REW lever (25) is controlled by the F FWD/REW stopper (33) of the mode select slide (18), the F FWD/REW roller (23) will not engage either the supply reel base (32) or the take-up reel base (10).

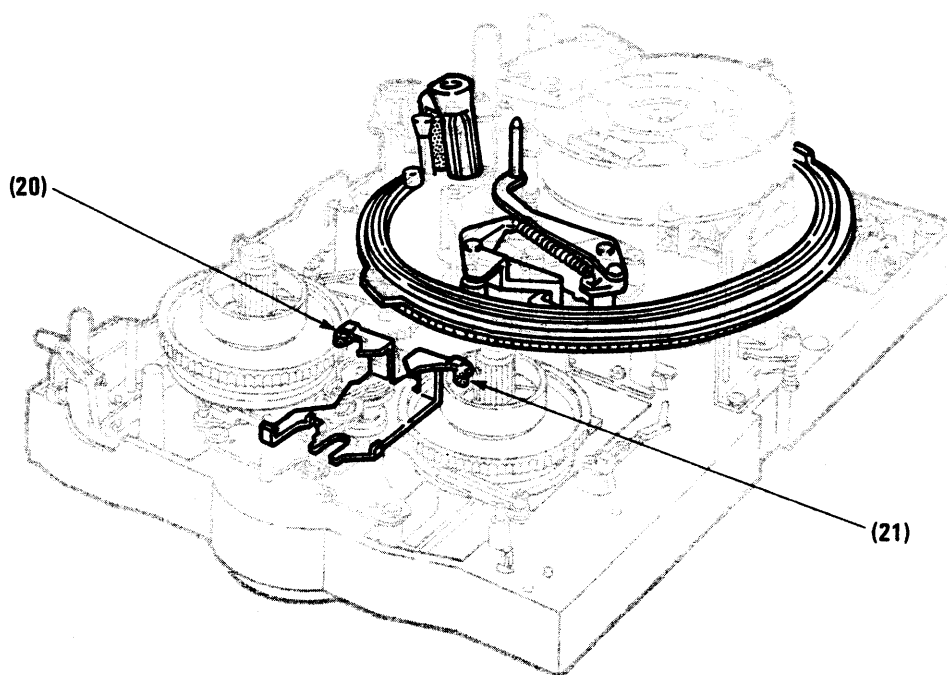


Fig. 3-3-10

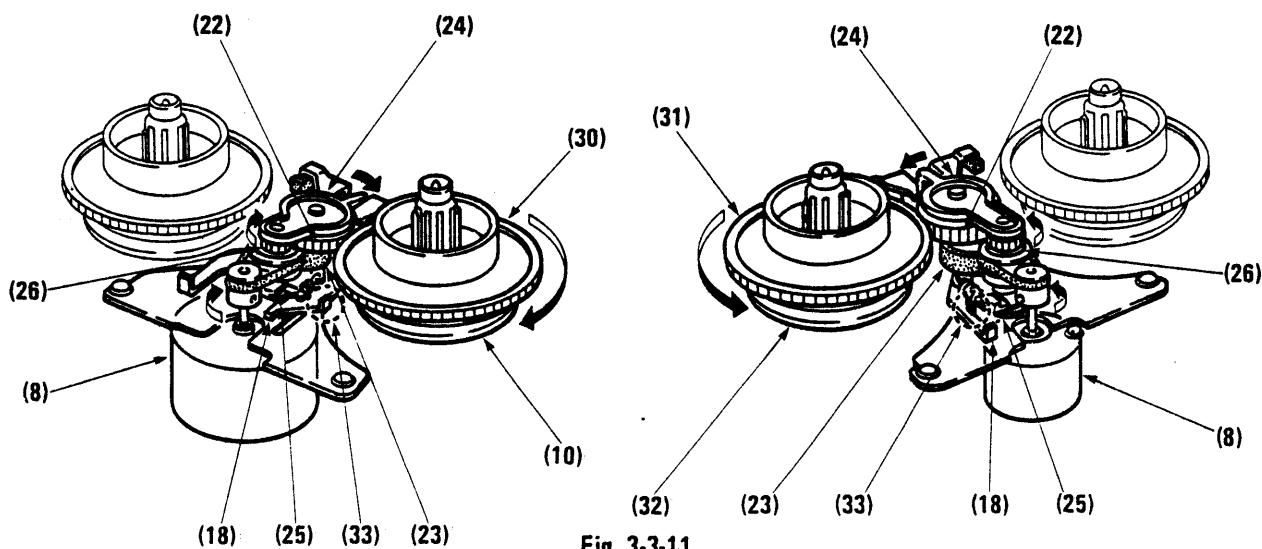


Fig. 3-3-11

Fig. 3-3-12 shows a F FWD or REW condition, with the supply reel brake (20) and the take-up reel brake (21) disengaged. If, at this time, the reel motor (8) rotates in the clockwise direction as shown in Fig. 3-3-13, the center gear (26) will rotate in the clockwise direction. This rotation force will then cause the F FWD/REW roller (23) to swing in the direction indicated by the arrow, and the F FWD/REW roller (23) will mesh with the take-up reel base (10). In the same way, if the rotation direction of the reel motor (8)

is reversed, the F FWD/REW roller (23) will mesh with the supply reel base (32). In the F FWD and REW modes, the F FWD/REW roller (23) meshes with the lower gear of the supply reel base (32) and the lower gear of the take-up reel base (10), respectively, and direct drive is performed. At this time, because the play lever (24) is controlled by the play stopper (34) of the mode select slide (18), the play gear (22) will not engage either the supply reel gear (31) or the take-up reel gear (30).

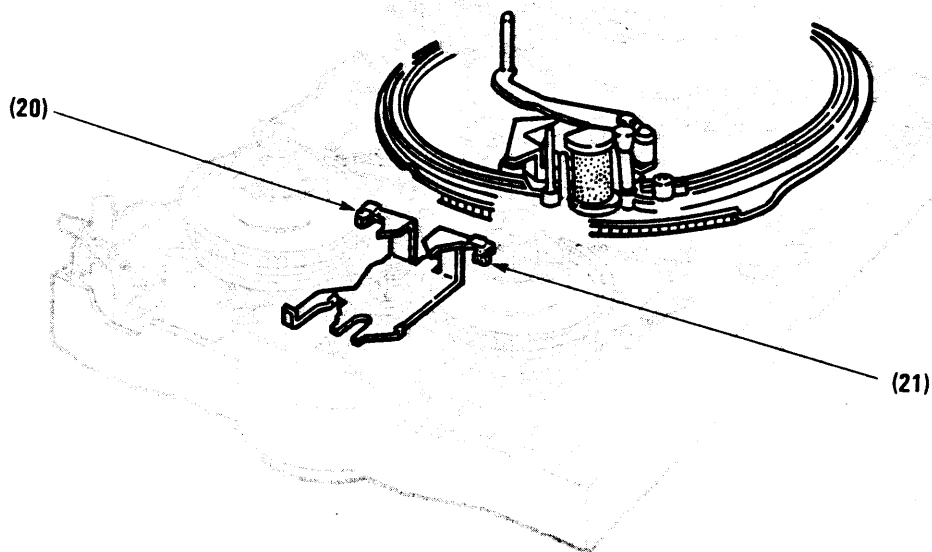


Fig. 3-3-12

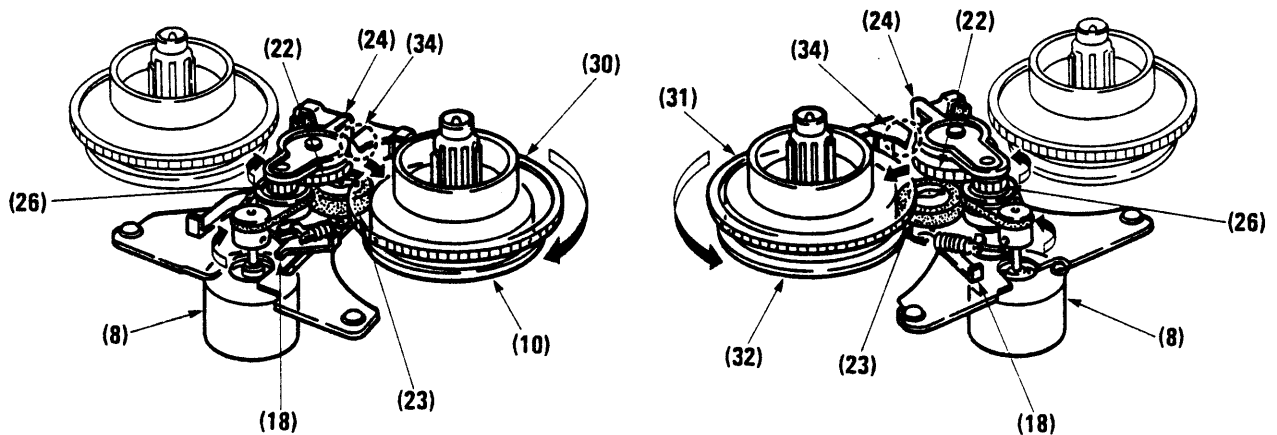


Fig. 3-3-13

3. PLAY MODE (See Figs. 3-3-14 ~ 3-3-16.)

- (1) The PLAY button is pressed.
- (2) The loading motor (3) rotates in the clockwise direction, and the rotation force of the loading motor (3) is transmitted to the loading ring (6) through the loading motor belt (4) and the loading gear assembly (5).
- (3) The loading ring (6) begins rotation in the counter clockwise direction, and the VCR enters the LOADING

mode. When the loading ring (6) begins rotation, the mode select lever (17) swings in the direction indicated by the arrow, thus causing the mode select slide (18), to which it is connected, to move in the direction indicated by the arrow and release both the supply reel brake (20) and the take-up reel brake (21). The cassette tape is pulled out by the various guides on the loading ring (6) and wound around the full-erase head, the video head drum, and the audio/control head.

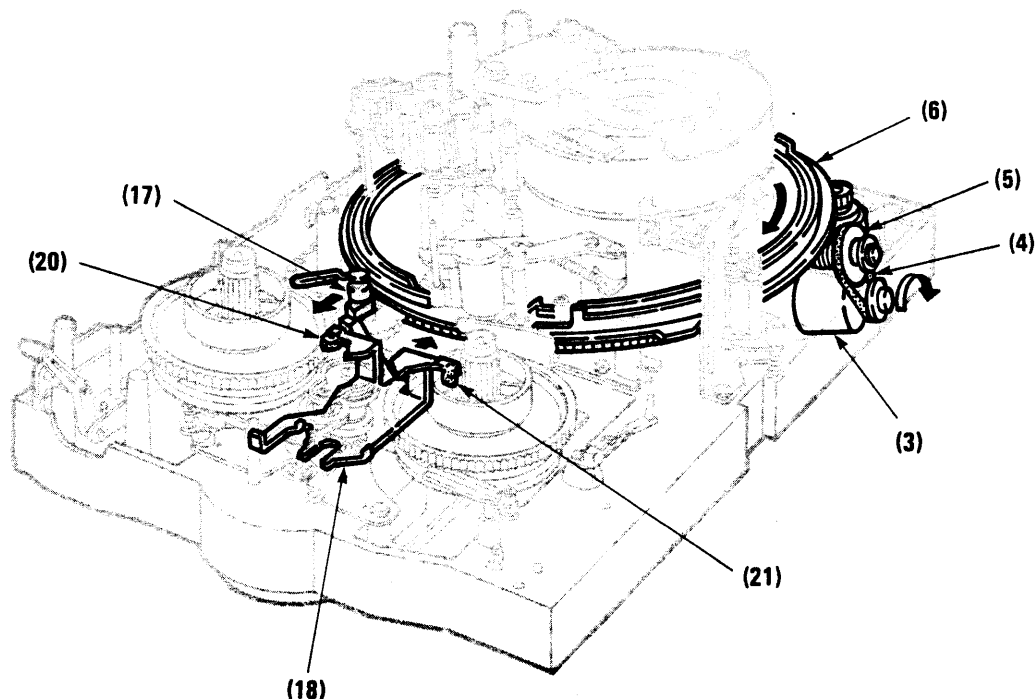


Fig. 3-3-14 LOADING mode

- (4) There are cams on various sections of the loading ring (6). When cam C reaches the position of loading-end roller (36) on the tip of the pinch roller pressure lever (35), the loading-end roller (36) will slip into cam C. In conjunction with the functioning of this pinch roller pressure lever (36), the loading-end switch (37) will become ON, the rotation of loading motor (3) will stop, and loading is complete.
- (5) Because the loading-end roller (36) slips into cam C on the loading ring (6) at the completion of loading, the pull of the pinch roller pressure spring (38) causes the pinch roller pressure lever (35) to press the pinch roller (39) against the capstan (40). (See Fig. 3-3-15.)

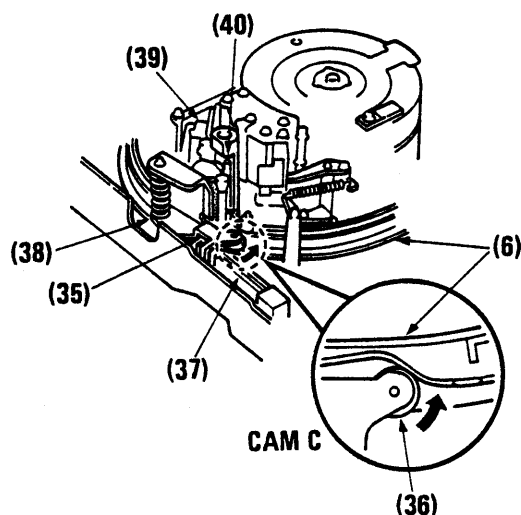
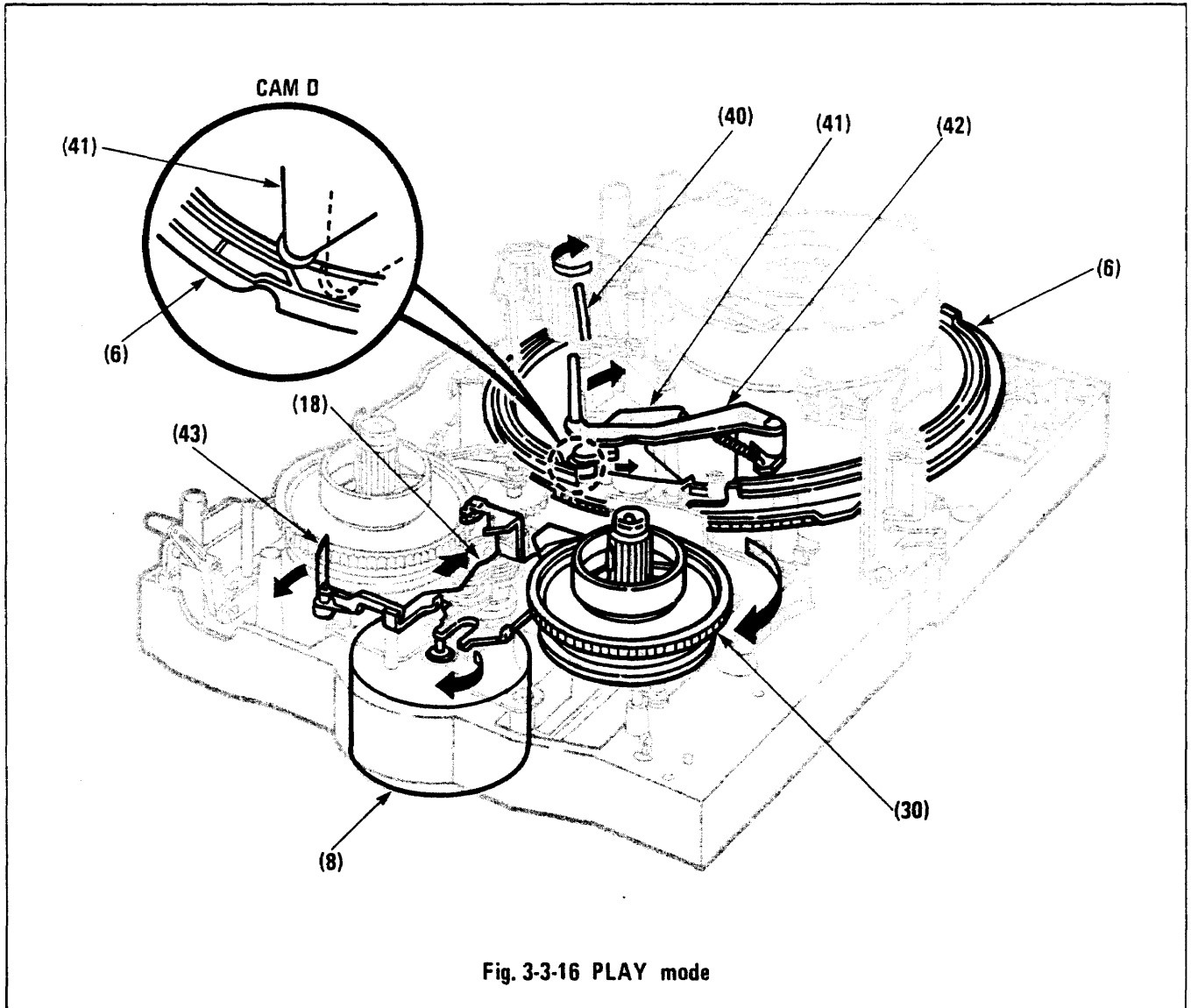


Fig. 3-3-15

(6) In addition, during loading, the back tension operation lever (41) is rotated in the counter clockwise direction by cam D on the loading ring (6), and the back tension lever (42) is set. Also, the movement of the mode select slide (18) causes the supply reel soft brake (43) to released.

(7) The reel motor (8) rotates in the clockwise direction, and the tape is wound around the take-up reel. (Refer to item "2. DRIVE PATH AND SWITCHING DIRECTION OF THE REEL BASE DRIVE IN EACH MODE".)

(8) The capstan (40) rotates, and the tape is driven.



4. F-SEARCH MODE (See Fig. 3-3-17.)

(1) While in the PLAY mode, the F-SEARCH button is pressed.

(2) The rotation speed of the capstan (40) increases, to provide forward search.

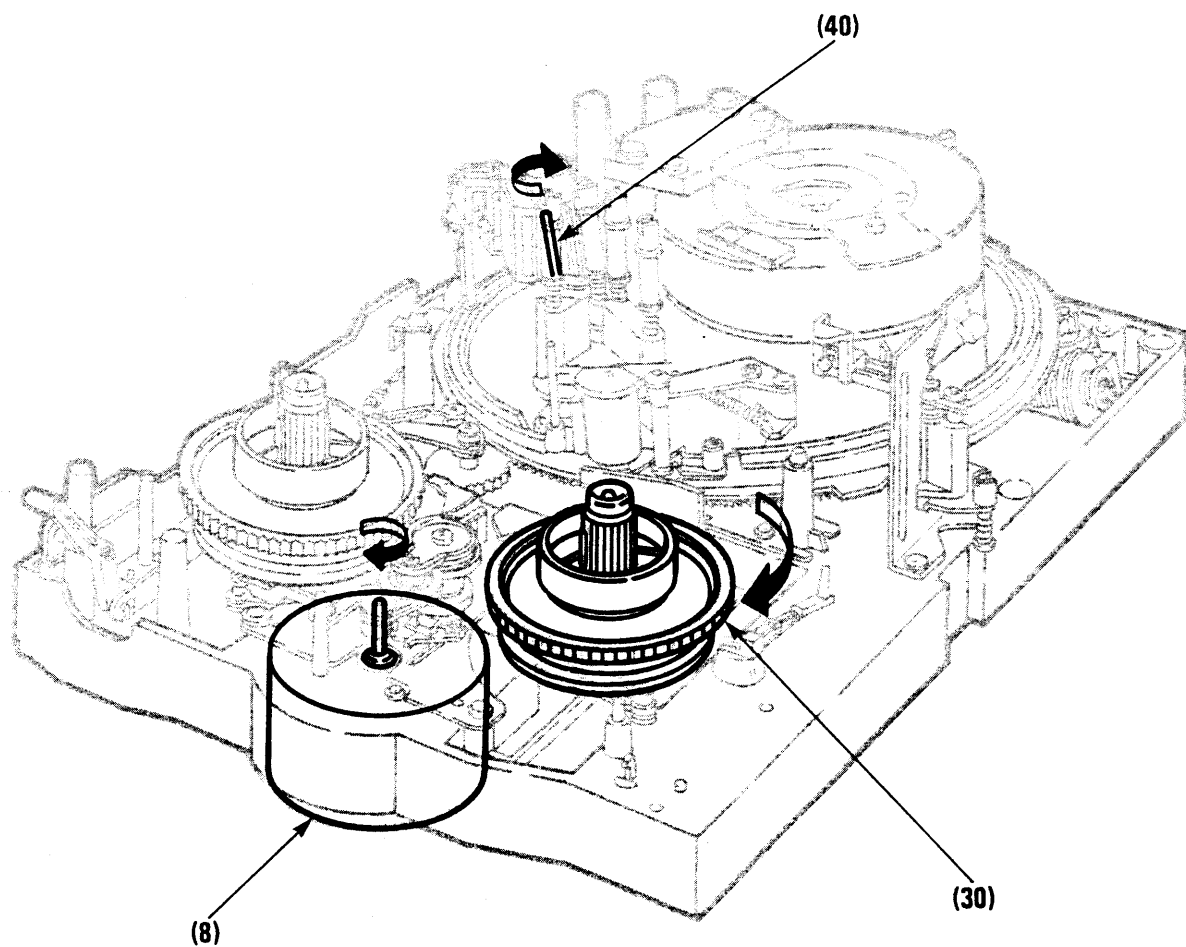


Fig. 3-3-17 F-SEARCH mode

5. R-SEARCH MODE (See Fig. 3-3-18.)

- (1) While in the PLAY mode, the R-SEARCH button is pressed.
- (2) The rotation speed of the capstan (40) increases.
- (3) The reel motor (8) begins reverse rotation, driving the supply reel gear (31), to provide reverse search.

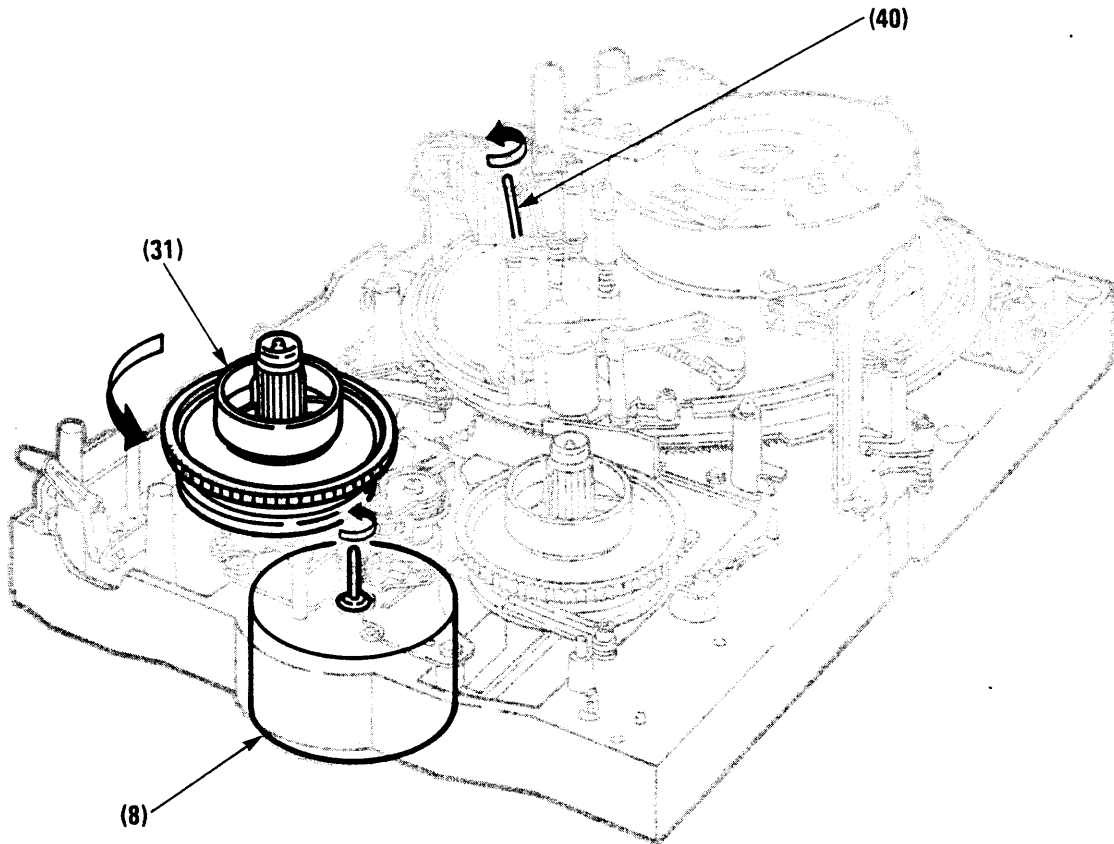


Fig. 3-3-18 R-SEARCH mode

6. F FWD MODE (See Figs. 3-3-19, 3-3-20.)

(1) While in the STOP mode, the F FWD button is pressed.
(2) The loading motor (3) rotates in the clockwise direction, and accordingly, the loading ring (6) rotates in the counter clockwise direction, causing the eject lock lever (44) to swing in the direction indicated by the arrow. When the eject lock lever (44) swings, the unloading-end switch (45) becomes OFF, and the loading motor (3) stops rotating.

(3) Once the loading ring (6) has rotated to the fixed position, the back tension operation lever (41) is swung in the counter clockwise direction by cam D, causing the back tension lever (42) to swing and a set amount of tape to be pulled out from the cassette.

(4) The reel motor (8) rotates in the clockwise direction, driving the take-up reel base (10) to wind the tape. (Refer to item "2. DRIVE PATH AND SWITCHING DIRECTION OF THE REEL BASE DRIVE IN EACH MODE".)

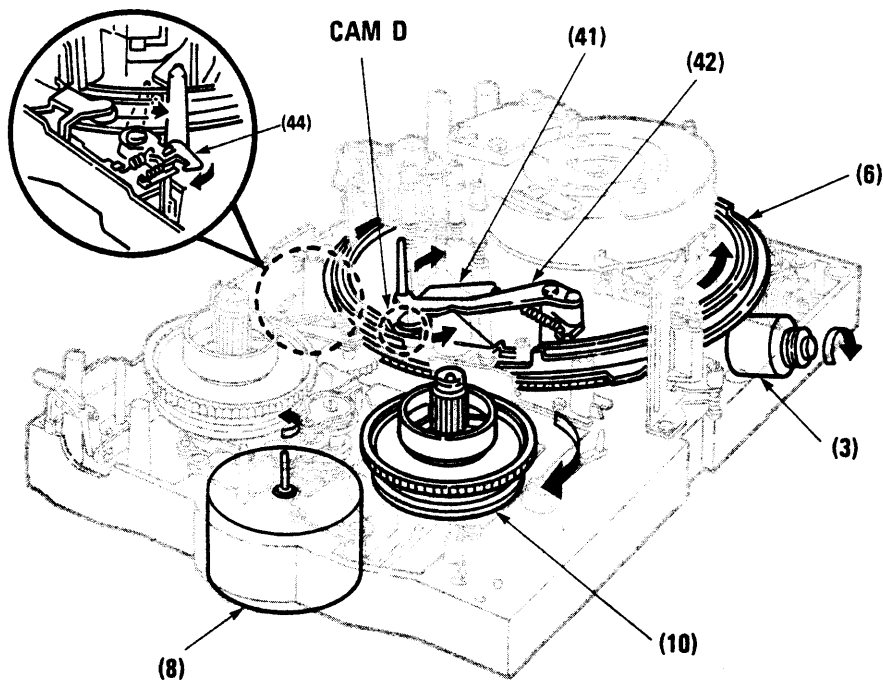


Fig. 3-3-19 F FWD mode

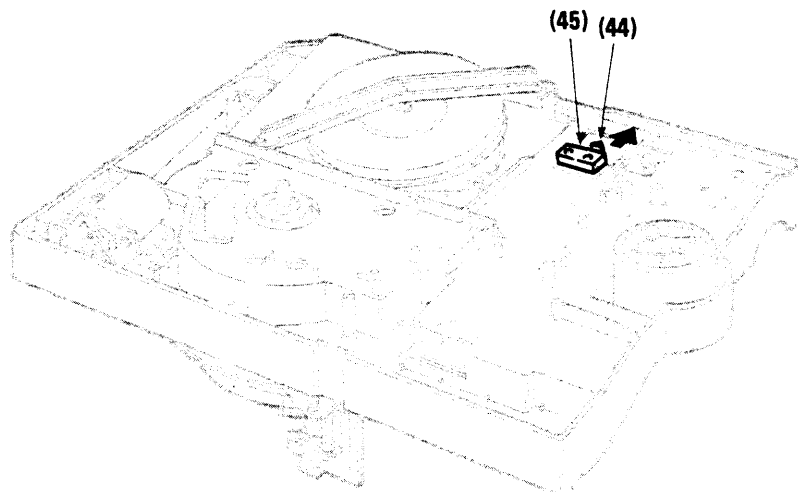


Fig. 3-3-20

7. REW MODE (See Figs. 3-3-21, 3-3-22.)

(1) While in the STOP mode, the REW button is pressed.
(2) The loading motor (3) rotates in the clockwise direction, and accordingly, the loading ring (6) rotates in the counter clockwise direction, causing the eject lock lever (44) to swing in the direction indicated by the arrow. When the eject lock lever (44) swings, the unloading-end switch (45) becomes OFF, and the loading motor (3) stops rotating.

(3) Once the loading ring (6) has rotated to the fixed position, the back tension operation lever (41) is swung in the counter clockwise direction by the cam D on the loading ring, causing the back tension lever (42) to swing and a set amount of tape to be pulled out from the cassette.

(4) The reel motor (8) rotates in the counter clockwise direction, driving the supply reel base (32) to wind the tape. (Refer to item "2. DRIVE PATH AND SWITCHING DIRECTION OF THE REEL BASE DRIVE IN EACH MODE".)

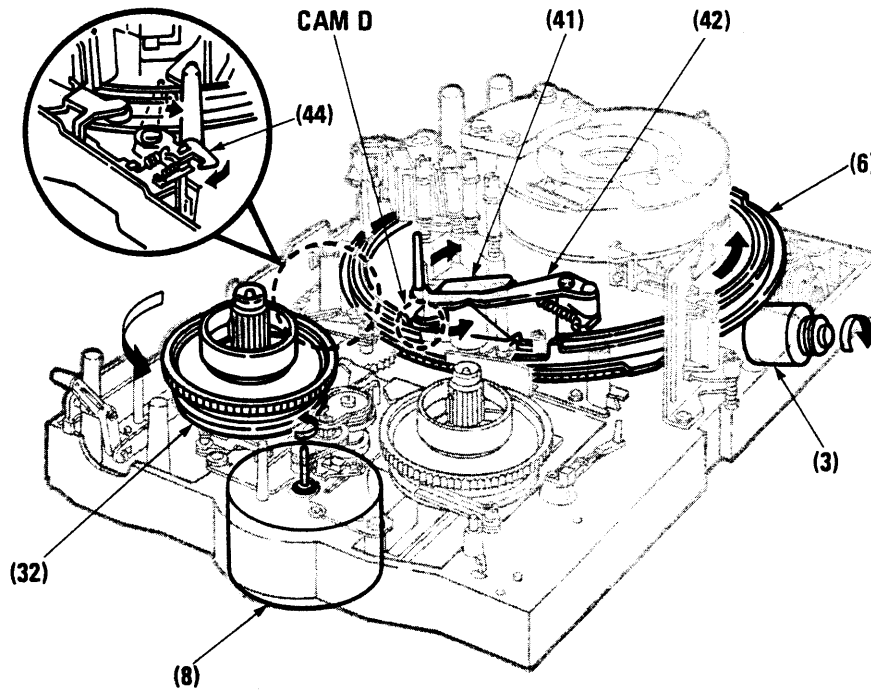


Fig. 3-3-21 REW mode

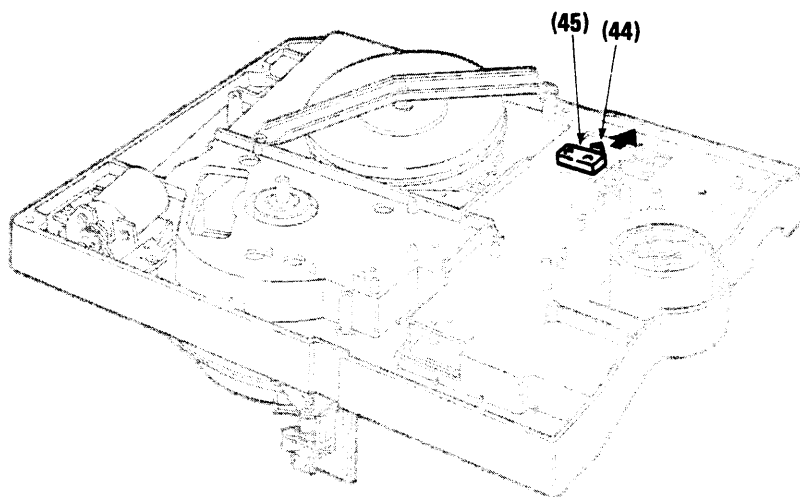


Fig. 3-3-22

8. REC MODE (See Fig. 3-3-23.)

- (1) The REC button is pressed.
- (2) If the erasure prevention switch (46) is ON, the VCR will enter the REC mode.
- (3) The mechanism operation is the same as that for the PLAY mode. (Refer to item "3. PLAY MODE".)

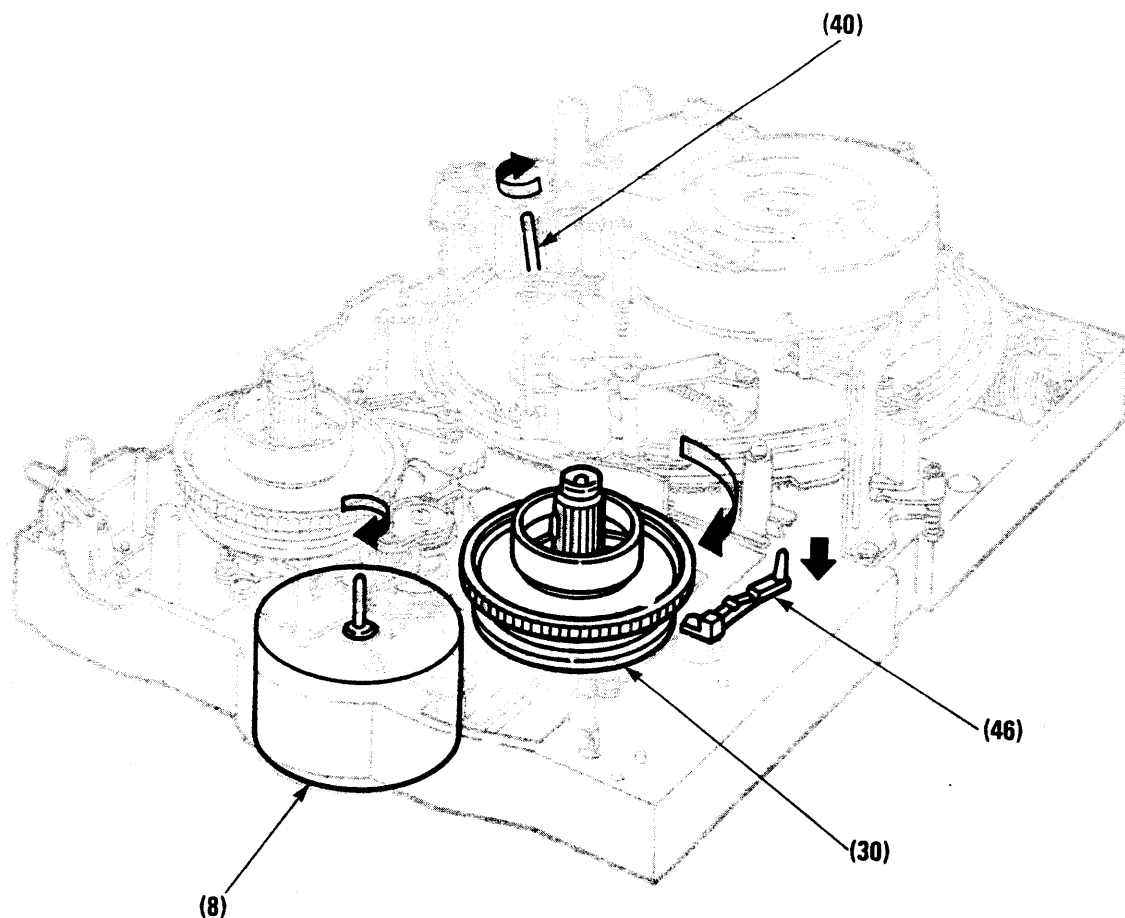


Fig. 3-3-23 REC mode

9. PAUSE MODE (See Fig. 3-3-24.)

- (1) While in the REC mode, the PAUSE button is pressed.
- (2) Both the capstan (40) and the reel motor (8) begin reverse rotation, and the VCR changes to the R-SEARCH mode for one second only. (Refer to item "5. R-SEARCH MODE".)
- (3) The capstan (40) stops rotating.
- (4) The tape drive stops and is in a standby condition. The reel motor (8), however, continues to rotate.

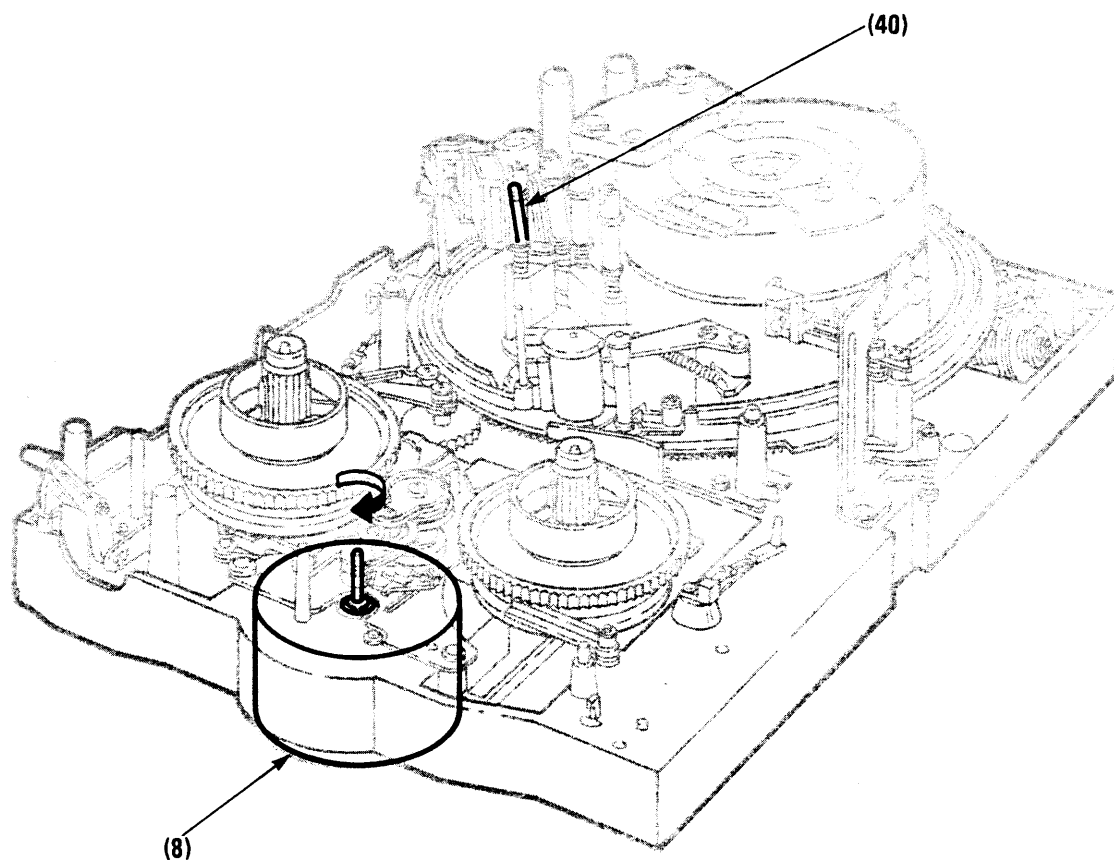


Fig. 3-3-24 PAUSE mode

10. FROM UNLOADING TO THE STOP MODE

(See Figs. 3-3-25 ~ 3-3-27.)

(1) The STOP button is pressed during any mode other than the STOP mode.

(2) The loading motor (3) rotates in the counter clockwise direction, and this rotation force is transmitted to the loading ring (6) through the loading motor belt (4) and the loading gear assembly (5).

(3) The loading ring (6) begins rotation in the clockwise direction, and the VCR enters the UNLOADING mode.

(4) Boss E on the back of the loading ring (6) presses against the eject lock lever (44), and the eject lock lever (44) swings in the direction indicated by the arrow.

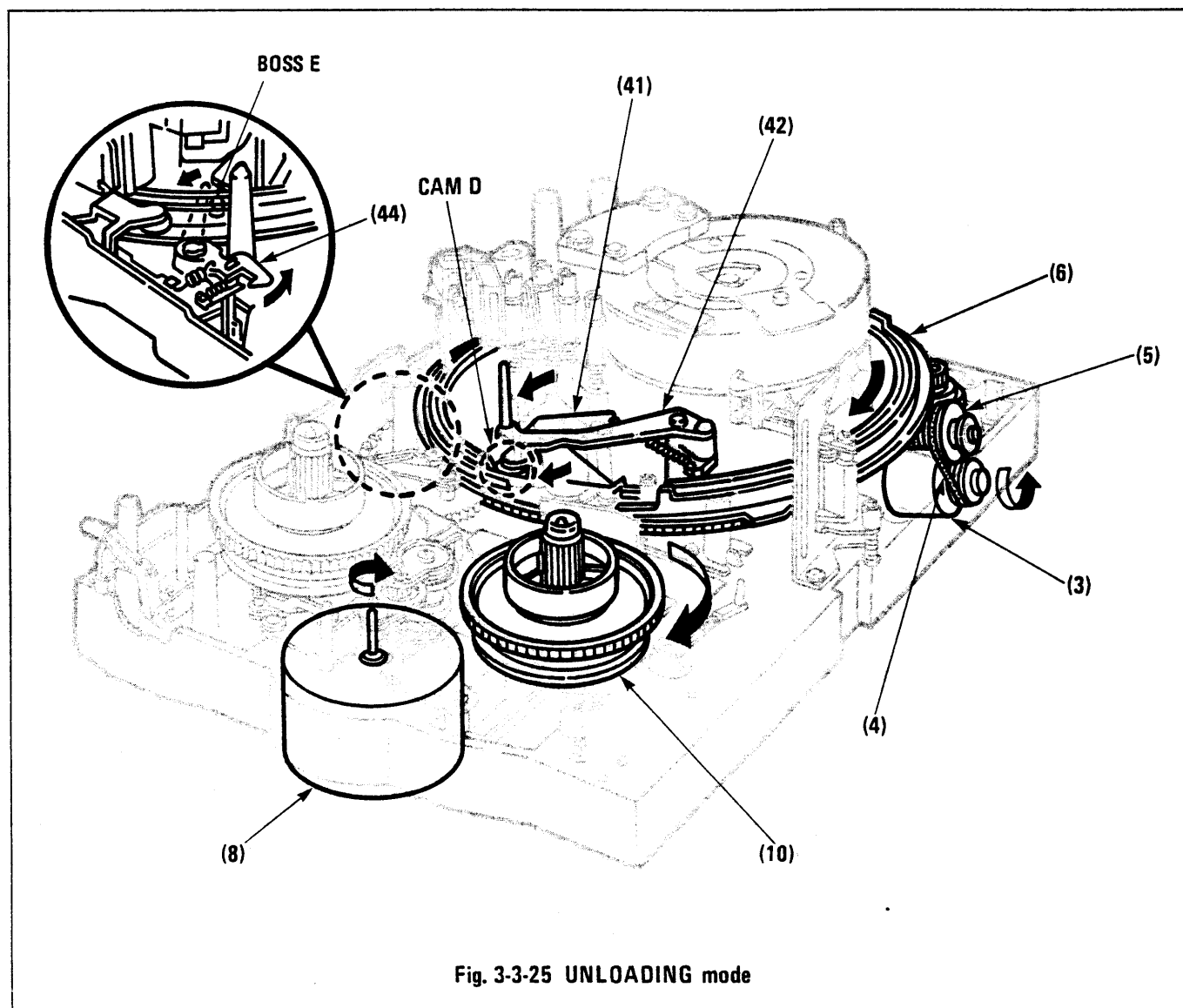
(5) The unloading-end switch (45) becomes ON, the loading

motor stops rotating, and unloading is complete.

(6) In the unloading mode, the reel motor (8) rotates in the clockwise direction, driving the take-up reel base (10) to wind the tape.

(7) In addition, during unloading, the back tension operation lever (41) is swung in the clockwise direction by cam D on the loading ring (6). At the completion of unloading, the back tension lever (42) returns the tape back into the opening in the cassette.

(8) At the completion of unloading, the movement of the mode select slide (18) causes the supply reel brake (20) and the take-up reel brake (21) to be applied to the supply reel base and the take-up reel base, respectively, and the VCR is set to the STOP mode.



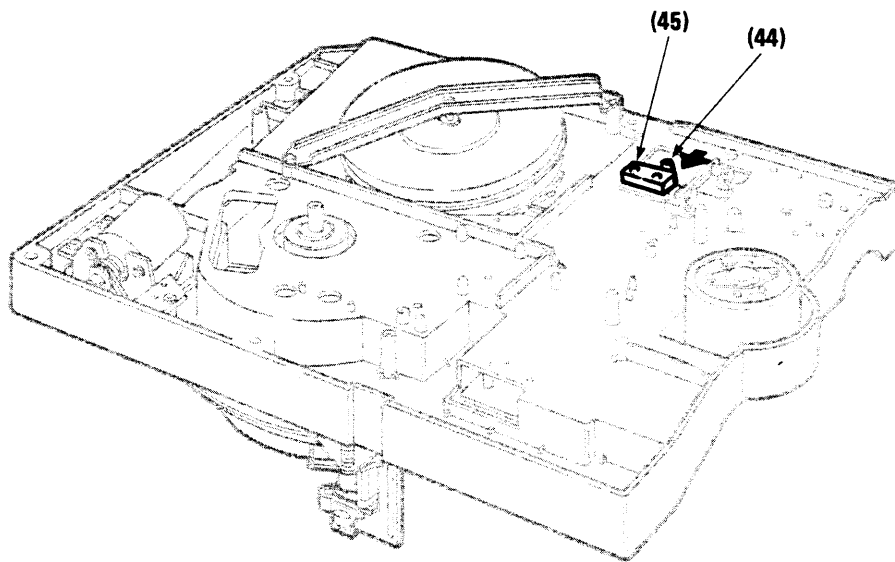


Fig. 3-3-26

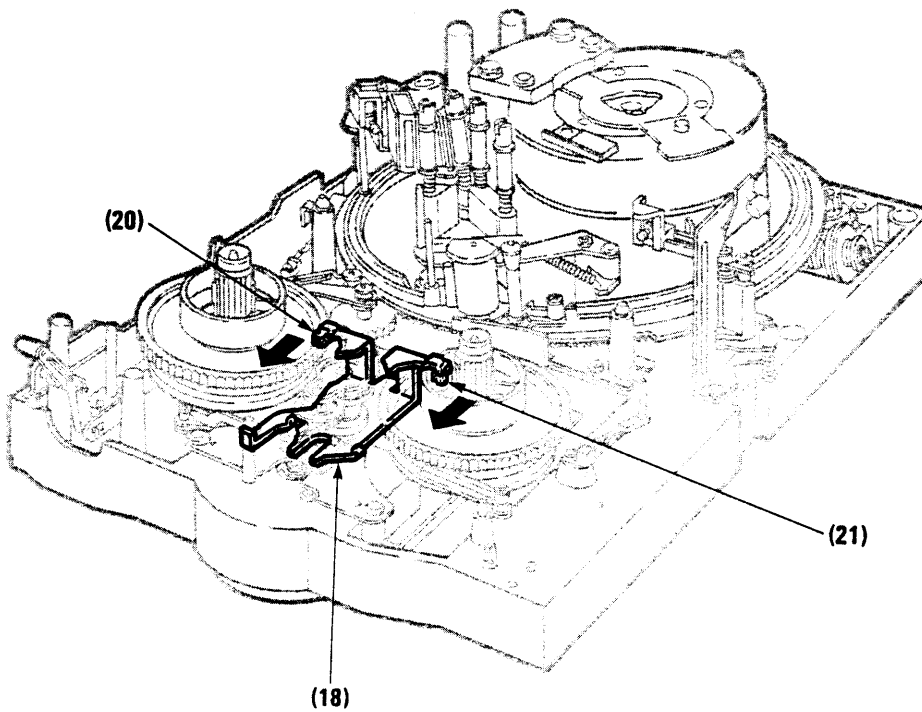


Fig. 3-3-27 STOP mode

11. CASSETTE-UP MODE (See Figs. 3-3-28, 3-3-29.)

- (1) While in the STOP mode, the EJECT button is pressed.
- (2) The eject slide (47) moves in the direction indicated by the arrow, the cassette holder lock lever (15) is released, and

the cassette holder moves upward.

- (3) At the same time, the cassette detection slide (14) moves upward, the cassette-in switch (16) becomes OFF, and the CASSETTE-UP mode is complete.

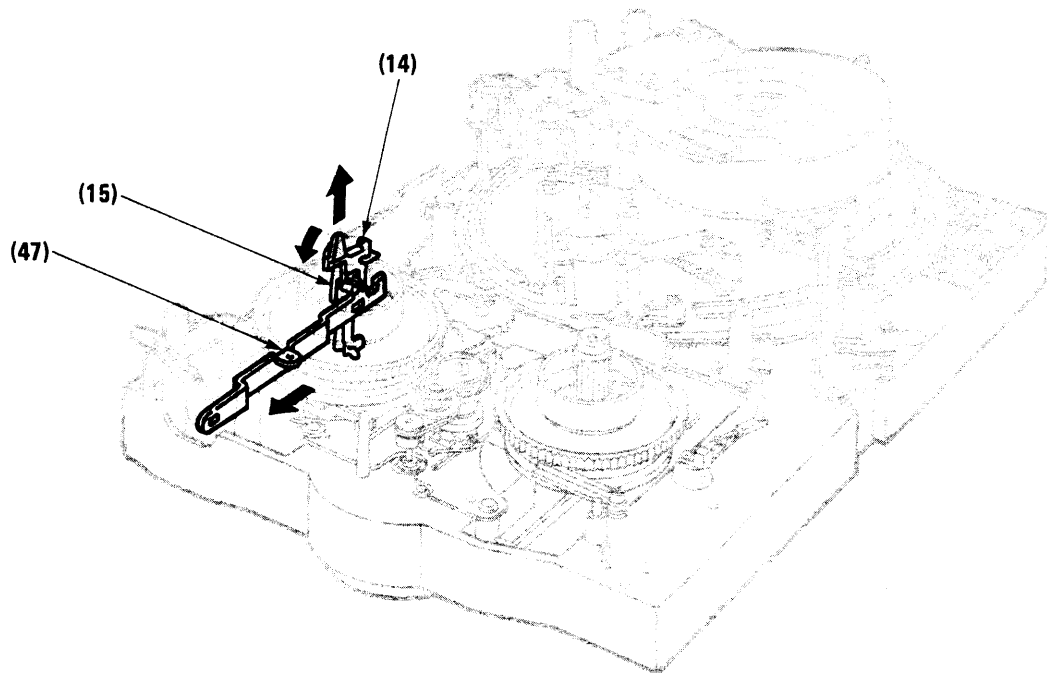


Fig. 3-3-28 CASSETTE-UP mode

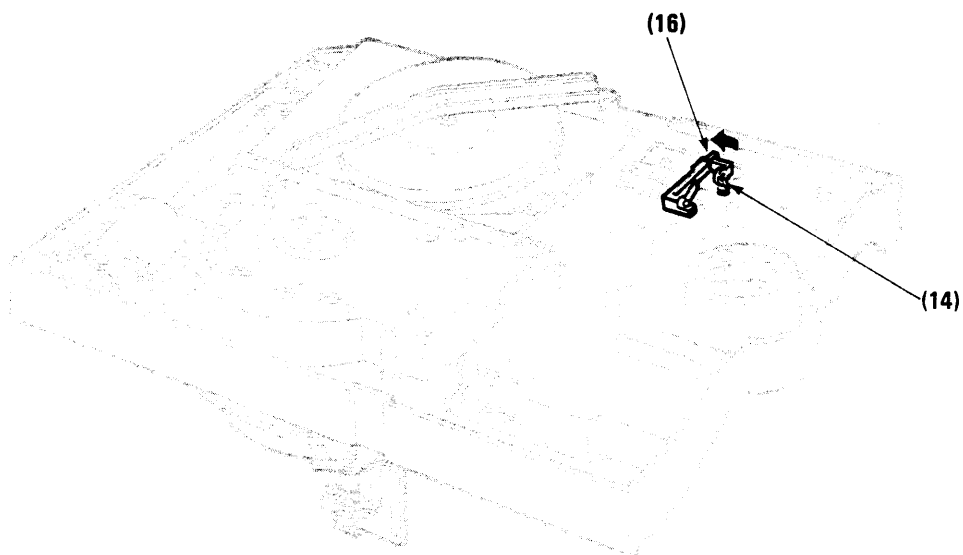


Fig. 3-3-29

IV. CABINET DISASSEMBLY

1. CASSETTE COVER

Remove the veil from Cassette Cover with small screwdriver. Remove two screws (a) on the Cassette Cover as indicated, and remove the Cassette Cover.

2. CABINET TOP

Remove three screws (b) on the Cabinet Top as indicated, and carefully lift up the Cabinet Top.

3. BOTTOM PLATE

Place the VCR with the right side down on a soft surface, and remove screw (c) and seven screws (d) on the Bottom Plate as indicated.

4. FRONT PANEL ASSEMBLY

Remove six screws (e) securing Front Panel, and remove the Front Panel.

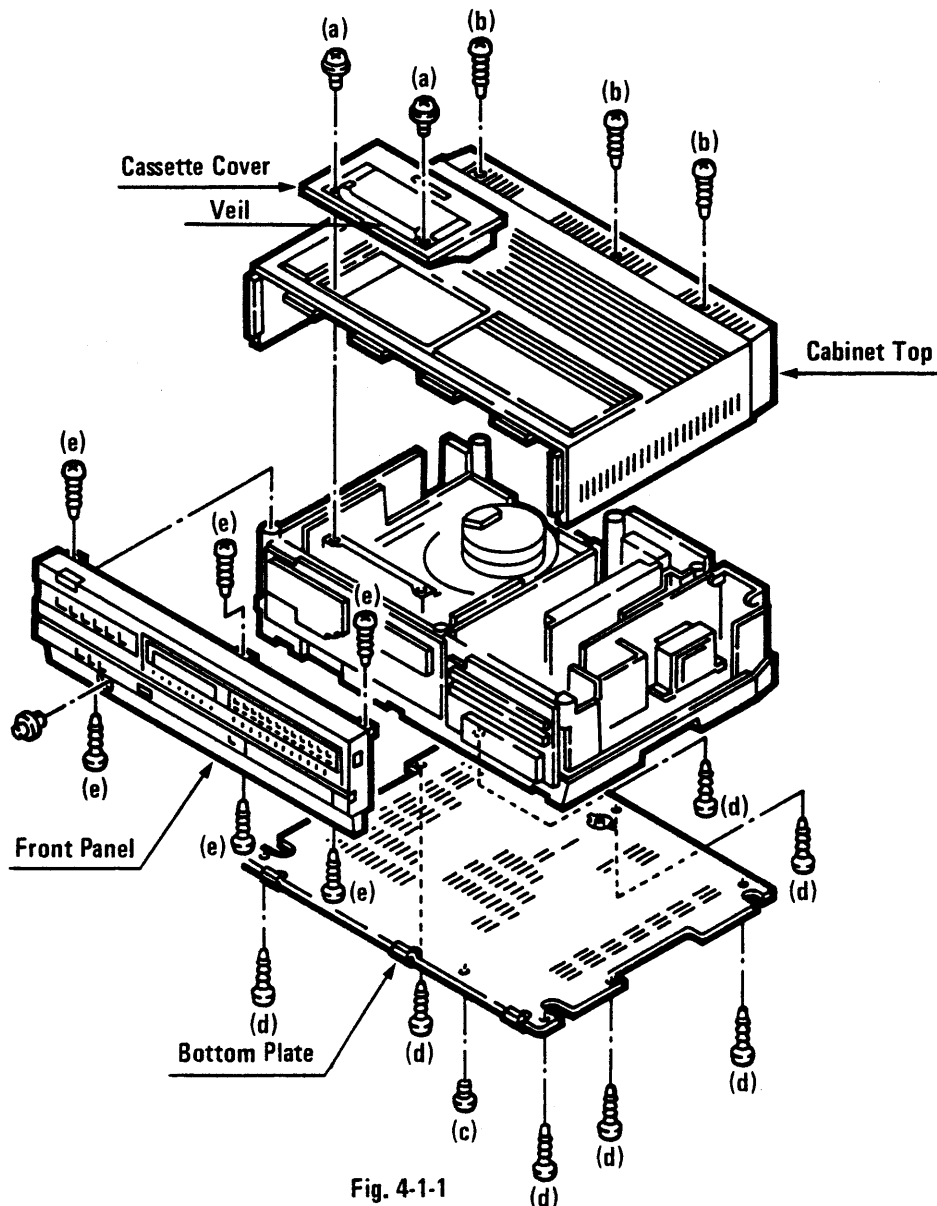


Fig. 4-1-1

V. CIRCUIT BOARD DISASSEMBLY

A. CIRCUIT BOARD LOCATIONS

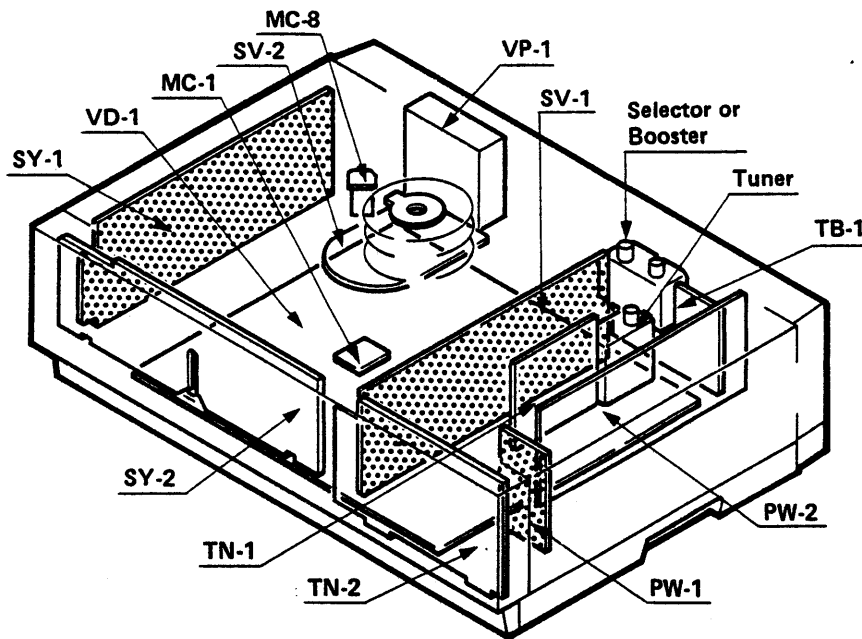


Fig. 5-1-1

B. CIRCUIT BOARD DISASSEMBLY

Circuit boards SV-1, TN-1 and TB-1 are not held in place by screws. They can be removed by lifting them up, so further explanation will be omitted here. Each circuit board has several connectors connected to them, so pay careful attention when removing them.

1. BOTTOM CIRCUIT BOARD (VD-1: VIDEO PREAMP, VIDEO, AUDIO AND RF CONVERTER CIRCUIT)

- (1) Place the VCR with the right side down on a soft surface.
- (2) Remove the Bottom Plate as explained in IV. CABINET DISASSEMBLY.
- (3) Remove eight screws (a) on the Bottom Circuit Board. The Board opens to the left as illustrated in Fig. 5-2-1.

Note:

It is possible to adjust and/or change the components on the Bottom Board in this condition.

To completely remove the Bottom Board from the chassis:

- (4) Disconnect ten connectors from the Board.
- (5) Disengage the Hinge at the lower left corner of the Board and then at the top left.

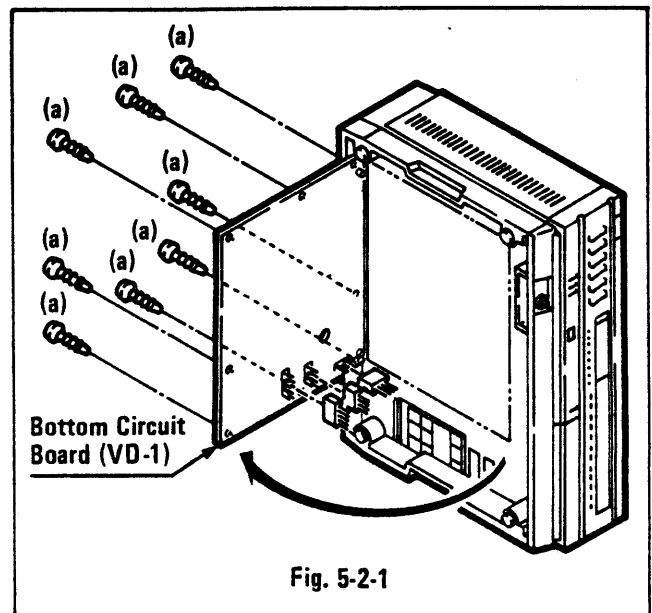
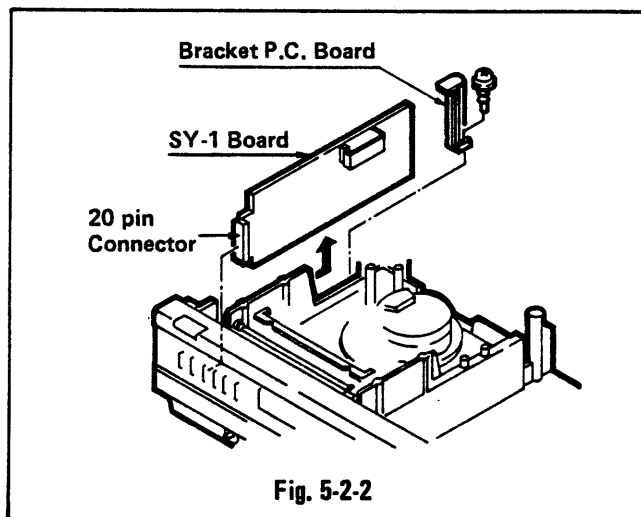


Fig. 5-2-1

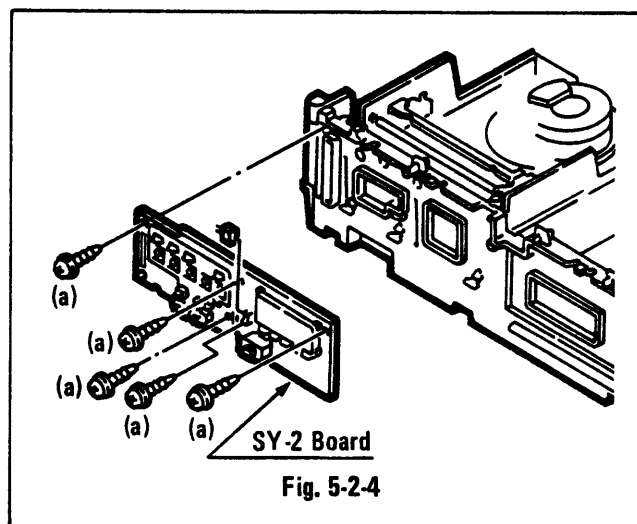
2. SY-1 BOARD (SYSTEM CONTROL CIRCUIT)

- (1) Remove screw (a) retaining the Bracket P.C. Board and lift up the Bracket P.C. Board.
- (2) Disconnect connectors from the Board and pull out the Board as illustrated in Fig. 5-2-2.



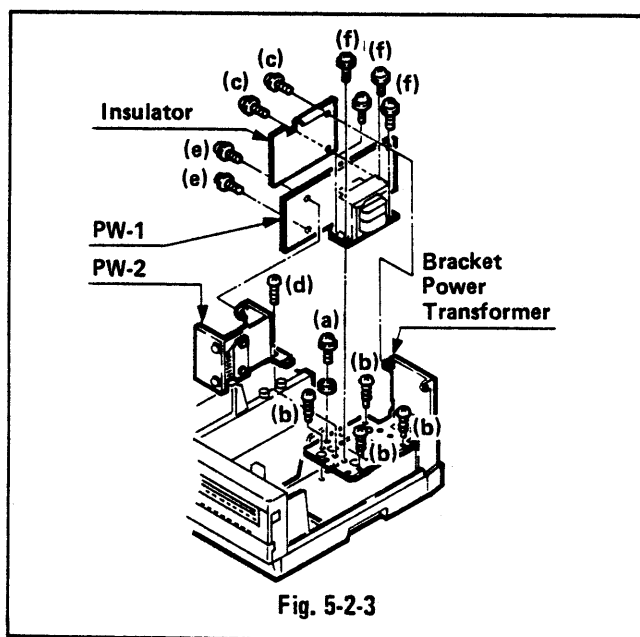
4. SY-2 BOARD (SYSTEM CONTROL, SERVO AND TIMER CIRCUIT)

- (1) Remove five screws (a).
- (2) Disconnect connectors from the Board and remove the Board as illustrated in Fig. 5-2-4.



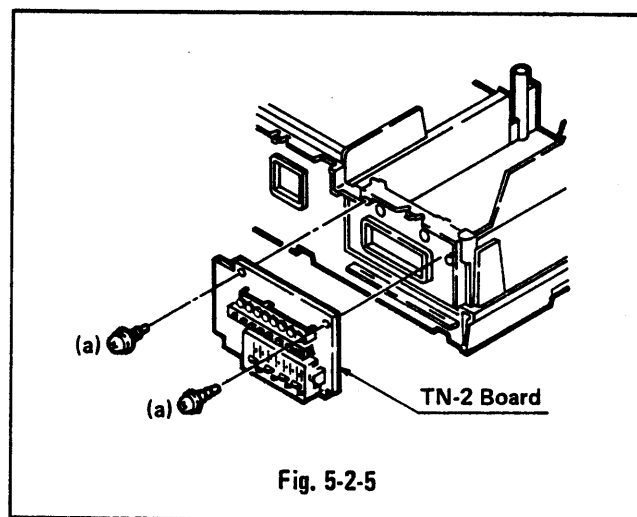
3. PW-1-PW-2 BOARD (PW-1: DC POWER SUPPLY, PW-2: SWITCHING)

- (1) Remove five screws (a) and (b) retaining the Bracket Power Transformer and carefully lift up the Bracket Power Transformer.
- (2) Remove screw (c) retaining the Insulator and lift up the Insulator.
- (3) Remove screw (d) and (e) retaining the Heat sink.
- (4) Remove screws (f) retaining the Board and Bracket Power Transformer.



5. TN-2 BOARD (TUNER CHANNEL PRESET CIRCUIT)

- (1) Remove two screws (a).
- (2) Disconnect two connectors from the Board and remove the Board as illustrated in Fig. 5-2-5.



VI. CIRCUIT ADJUSTMENTS

A. POWER SUPPLY CIRCUIT (PW-2 CIRCUIT BOARD)

1. +10V Adjustment

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR5201	TP5201 TP5202	Digital voltmeter	Power switch "ON" STOP mode
a. Connect the digital voltmeter to TP5201 and TP5202 (earth). b. Adjust VR5201 so that the voltage is $DC\ 9.8 \pm 0.1V$.			

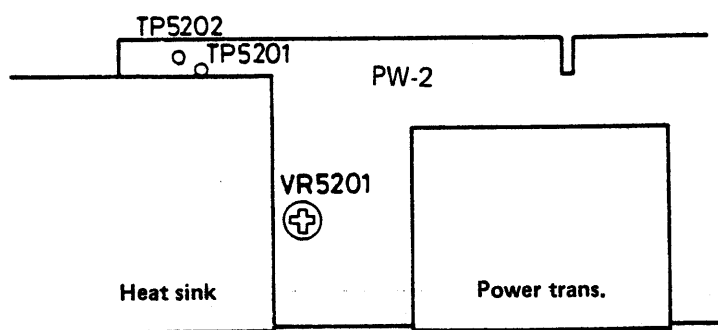


Fig. 6-1-1 PW-2 Circuit board (Parts side view)

B. TUNER CIRCUIT (TN-1 CIRCUIT BOARD)

(Refer to Fig. 6-2-2.)

Connect a sweep marker generator and an oscilloscope as shown in Fig. 6-2-1.

Supply the output signal from the sweep marker generator to the TN-1 circuit board through an input probe, and supply the output signal from the circuit board, through an output probe, to the oscilloscope.

Set the tuner band selector to the "III"* position.

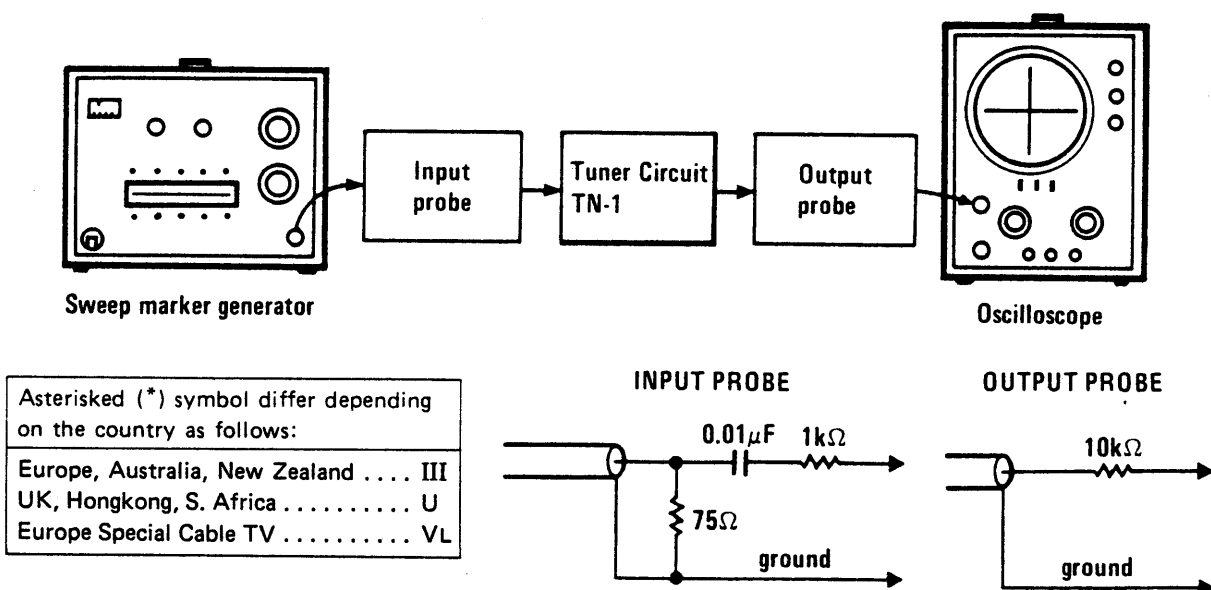


Fig. 6-2-1

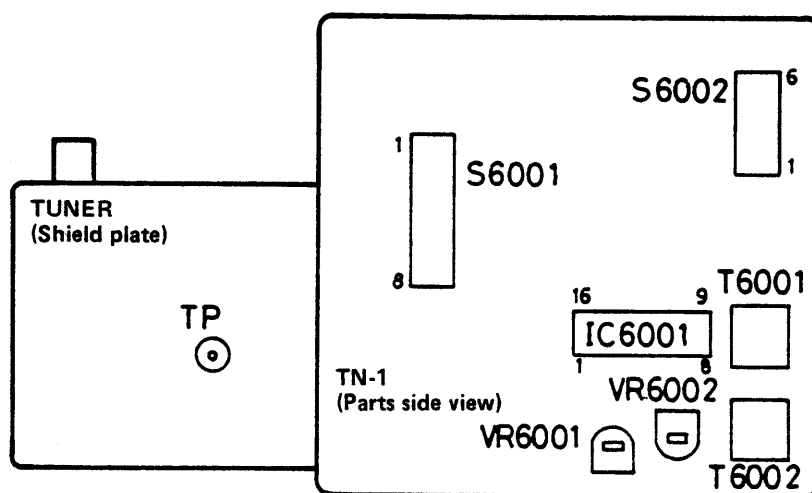


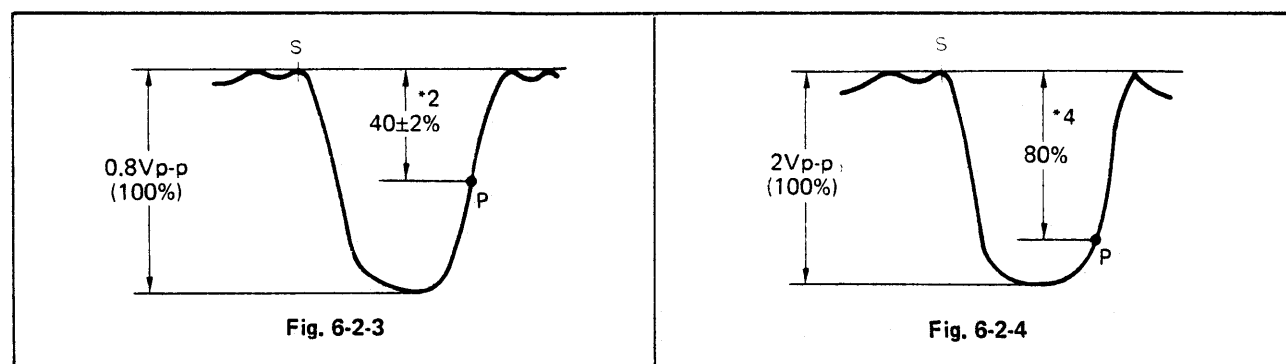
Fig. 6-2-2 TN-1 Circuit Board (Parts side view)

1. VIF Adjustment

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
Converter transformer	E of Q6004	Sweep marker generator Oscilloscope DC power supply Special screwdriver	STOP mode
a. Connect a 22-ohm resistor between pin (9) and pin (8) of IC6001 and disconnect the S6002 connector. b. Supply DC +0.8V to pin (14) of IC6001 as an AGC voltage. c. Set the output level of the sweep marker generator to VIF, -25 dB (28mVrms), and connect the output to the TP terminal of tuner through an input probe. d. Connect the output signal at E of Q6003 on the circuit board to the oscilloscope through an output probe, and observe the waveform. e. Adjust the AGC voltage so that the waveform level is equal to 0.8Vp-p. f. Adjust the converter transformer of the tuner so that P (the 38.9-MHz marker) becomes $40 \pm 2\%$. (See Fig. 6-2-3.) g. Remove the 22-ohm resistor, and reconnect the S6002 connector			

2. Detection Transformer

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
T6001	E or Q6003	Sweep marker generator Oscilloscope DC power supply Special screwdriver	STOP mode
a. Supply DC +2V to pin (14) of IC6001 as an AGC voltage, and remove the S6002 connector. b. Set the output level of the sweep marker generator to VIF, -25dB (28mVrms), and connect the output to the TP terminal of tuner through an input probe. c. Connect the output signal at E of Q6003 on the circuit board to the oscilloscope through an output probe, and observe the waveform. d. Adjust AGC voltage so that the waveform level is equal to 2.5Vp-p. e. Adjust the T6001 core so that P (the 38.9-MHz marker) becomes 80%. (See Fig. 6-2-4.) f. Connect the S6002 connector.			



3. AFT Circuit (1)

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
T6002	Pin (6) of S6001	Sweep marker generator Oscilloscope DC power supply Special screwdriver	STOP mode AFT switch "ON"

a. Supply DC +3.5V to Pin (14) of IC6001 as an AGC voltage.
b. Set the output level of the sweep marker generator to VIF, -13dB (112mVrms), and connect the output to the TP terminal of the tuner through an input probe. (See Fig. 6-2-2.)
c. Connect the output signal at pin (6) of S6001 on the circuit board to the oscilloscope through an output probe, and observe the waveform.
d. Adjust T6002 so that P (the 38.9^{*5}-MHz marker) is positioned on the base line.

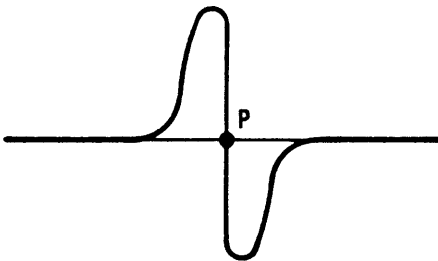


Fig. 6-2-5

4. AFT Circuit (2)

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR6002	Pin (6) of IC6001 Pin (5) of IC6001	DC power supply DC voltmeter	STOP mode AFT switch "ON"

a. Eliminate all input signals.
b. Apply DC +5 ~8V to pin (14) of IC6001.
c. Adjust VR6002 so that the voltage between pin (6) of IC6001 and pin (5) of IC6001 is 0~0.5V.

Asterisked (*) numerals differ depending on the country as follows.

	*1	*2	*3	*4	*5
Europe	38.9MHz	40±2%	38.9MHz	80%	38.9MHz
UK, Hongkong, S. Africa	39.5MHz	38±10%	39.5MHz	70%	39.5MHz
Australia, New Zealand	36.875MHz	40±2%	36.875MHz	80%	36.875MHz
Europe Special Cable TV	38.9MHz	35±2%	38.9MHz	75%	38.9MHz

5. RF AGC Circuit

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR6001	Tuner AGC terminal	Colour-bar generator with RF Digital voltmeter	STOP mode
a. Connect the colour-bar generator to the antenna input connector (ANT IN) of the VCR. (VHF input: channel 5 or UHF: input channel 31. $69\text{dB}\mu \pm 1\text{dB}\mu$; modulation degree 87.5%) b. Press the channel selector corresponding to channel 5 or 31, and tune the VCR for the best possible reception by observing the picture on the screen. c. Set the AFT switch to the "ON" position. d. Measure the voltage at the AGC terminal of the tuner, and adjust VR6001 so that the voltage is $5.7 \pm 0.1\text{V}$. (UHF: $5.0 \pm 0.1\text{V}$)			

6. Audio Output

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
—	Pin (4) of S6002	TV signal generator Oscilloscope	STOP mode
a. Connect the TV signal generator to the antenna input connector (ANT IN) of the VCR. [VHF input: channel 5, $60\text{dB}\mu$ (1mVrms) or higher, 60% modulation with sine audio signal at 400 Hz] b. Press the channel selector corresponding to channel 5, and tune the VCR for the best possible reception by observing the picture on the screen. c. Set the AFT switch to the "ON" position. d. Observe the waveform of the audio output signal at pin (4) of S6002 on the oscilloscope, and confirm so that the output level is equal to $0.69 \pm 0.34\text{Vp-p}$.			

Asterisk (*) numerals and symbols differ depending on the country as follows.

	*1	*2	*3	*4	*5	*6	*7	*8
Europe	VHF	Channel 5	$69\text{dB}\mu$	Channel 5	5.7	VHF	Channel 5	Channel 5
UK, Hongkong, S.Africa	UHF	Channel 31	$69\text{dB}\mu$	Channel 31	5.7	UHF	Channel 31	Channel 31
Australia, New Zealand	VHF	Channel 5	$66\text{dB}\mu$	Channel 5	4.5	VHF	Channel 5	Channel 5
Europe special Cable TV	VHF	Channel 5	$66\text{dB}\mu$	Channel 5	5.3	VHF	Channel 5	Channel 5

C. SERVO CIRCUIT (SV-1 CIRCUIT BOARD) (Refer to Fig. 6-3-1.)

[HEAD SERVO SYSTEM]

1. Head Switching Position Pre-setting

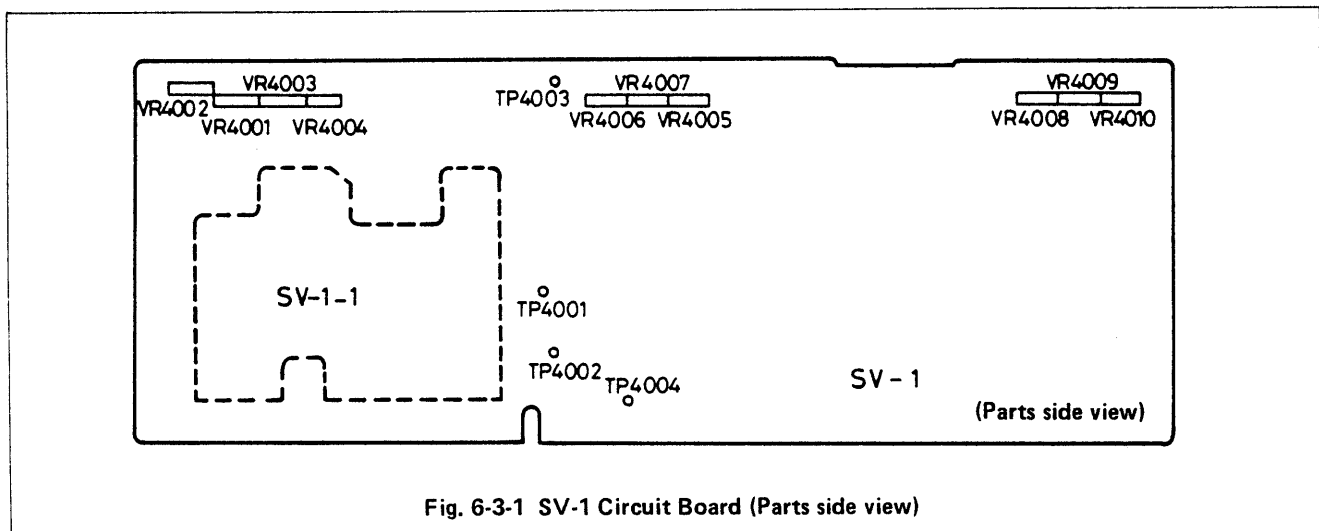
Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4001 VR4002	—	—	—
a. Align VR4001 and VR4002 to the centre position of the rotation angle.			

2. APC Lock

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4005	TP4002	Oscilloscope Video cassette	REC mode
a. Load a video cassette suitable for recording and set the VCR for the recording of a television broadcast. b. Connect the oscilloscope to TP4002. c. Adjust VR4005 so that the voltage is $DC\ 3.2 \pm 0.1V$.			

3. FWD Lock Position

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4003	TP4001 Video output terminal	Oscilloscope Video cassette	REC mode
a. Load a video cassette suitable for recording, and set the VCR for the recording of a television broadcast. b. Connect channel 1 of the oscilloscope to TP4001 (RF switching pulse). c. Connect channel 2 of the oscilloscope to the video output terminal. d. Adjust VR4003 so that the leading edge of the vertical synchronizing signal of the video signal (video output terminal) is delayed $7H \pm 0.5H$ from the fall of the RF switching pulse. (Refer to Fig. 6-3-2.)			



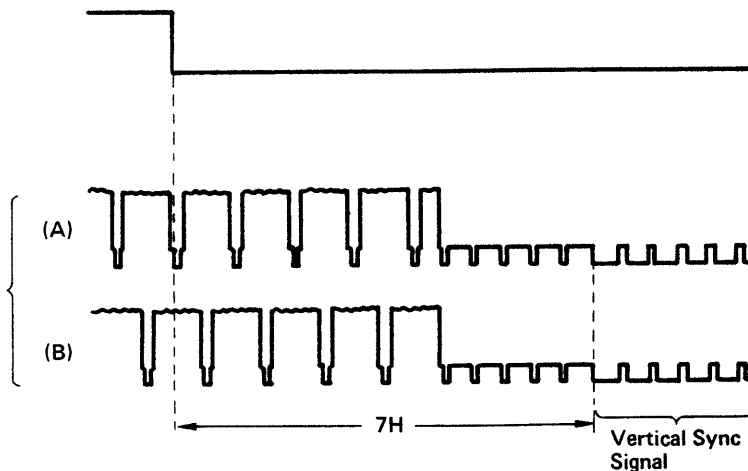
4. Head Switching Position

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4002 VR4001	TP4001 Video output terminal	Oscilloscope Alignment cassette (VJ-0113)	PLAY mode

- Load the alignment cassette (VJ-0113) and set the VCR to the PLAY mode.
- Connect channel 1 of the oscilloscope to TP4001 (RF switching pulse).
- Connect channel 2 of the oscilloscope to the video output terminal.
- Turn the tracking control knob so that the maximum amplitude of the RF signal is obtained.
- Adjust VR4001 so that the leading edge of the vertical synchronizing signal of the video signal (video output terminal) is delayed $7H \pm 0.5H$ from the fall of the RF switching pulse.
- Adjust VR4001 so that the leading edge of the vertical synchronizing signal of the video signal (video output terminal) is delayed $7H \pm 0.5H$ from the rise of the RF switching pulse.

CH-1
RF SW Pulse
TP4001

CH-2
Video Signal
(Video output
terminal)



CH-1
RF SW Pulse
TP4001

CH-2
Video Signal
(Video output
terminal)

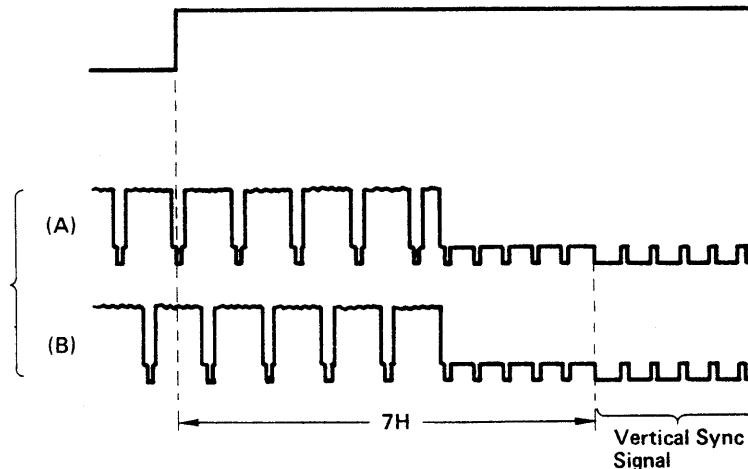


Fig. 6-3-2

5. FWD Search Lock

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4007	TP4002	Oscilloscope Video cassette	FWD Search mode
a. Load a video cassette suitable for recording, and set the VCR for the recording of a television broadcast. After recording the cassette, playback to FWD search mode. b. Connect the oscilloscope to TP4002. c. Adjust VR4007 so that the voltage is DC $3.2 \pm 0.1V$.			

6. REV Search Lock

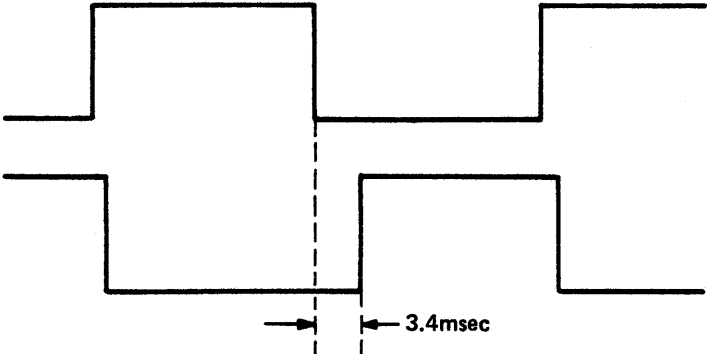
Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4006	Pin (3) of S4007	Oscilloscope Video cassette	REV Search mode
a. Load a video cassette suitable for recording, and set the VCR for the recording of a television broadcast. After recording the cassette, playback to REV search mode. b. Connect the oscilloscope to TP4002. c. Adjust VR4006 so that the voltage is DC $3.2 \pm 0.1V$.			

[CAPSTAN SERVO SYSTEM]

1. APC FWD Lock

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4010	TP4004	Oscilloscope Video cassette	REC mode
a. Load a video cassette suitable for recording, and then set the VCR for the recording of a television broadcast. b. Connect the oscilloscope to TP4004. c. Adjust VR4010 so that the voltage is DC $3.8 \pm 0.1V$.			

2. Tracking

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4004	TP4001 TP4005	Oscilloscope Video cassette	PLAY mode
a. Load a video cassette suitable for recording, and then set the VCR for the recording of a television broadcast. b. Set the tracking control to the centre (notched) position. c. Connect channel 1 of the oscilloscope to TP4001 (RF switching pulse). d. Connect channel 2 of the oscilloscope to TP4005 (playback control pulse). e. Playback the recorded television broadcast. f. Adjust VR4004 so that the rise of the playback control pulse is delayed to 3.4 ± 0.3 milliseconds after the fall of the RF switching pulse.			
CH-1 TP4001 (RF switching pulse) CH-2 TP4005 (Play-back control pulse)  → 3.4msec			
Fig. 6-3-3			

3. FWD Search Lock

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4009	TP4004	Oscilloscope Video cassette	FWD Search mode
a. Load a video cassette suitable for recording, and set the VCR for the recording of a television broadcast. After recording the cassette, playback to FWD search mode. b. Connect the oscilloscope to TP4004. c. Adjust VR4009 so that the voltage is DC 3.8 ± 0.1 V.			

4. REV Search Lock

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR4008	Pin (5) of S4007	Oscilloscope Video cassette	REV Search mode
a. Load a video cassette suitable for recording, and set the VCR for the recording of a television broadcast. After recording the cassette, playback to REV search mode. b. Connect the oscilloscope to TP4004. c. Adjust VR4008 so that the voltage is DC 3.8 ± 0.1 V.			

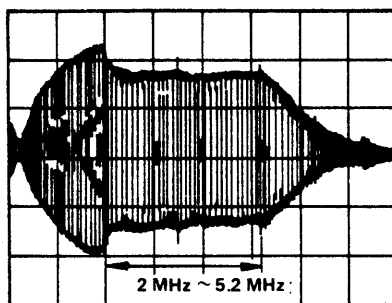
D. VIDEO CIRCUIT
(VP-1 AND VD-1 CIRCUIT BOARD)

[ADJUSTMENTS FOR THE VP-1]

1. Preamplifier Frequency Response

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1503 (channel A) VR1502 (channel B)	Pin (3) of S1502	Oscilloscope Alignment cassette (VJ-0113)	PLAY mode

- a. Load the alignment cassette (VJ-0113), and playback the RF sweep signal.
- b. Connect the oscilloscope to pin (3) of S1502.
 At this time, use pin (1) of S1502 (RF switching pulse) for the trigger pulse for waveform observation.
 Trigger slope +: Channel B
 -: Channel A
- c. Turn the tracking VR so that the waveform amplitude reaches the maximum level.
- d. Adjust VR1503 (channel A) and VR1502 (channel B), so that the amplitude at 5.2 MHz is about 100% $\pm$ 20% of the amplitude at 3.58 MHz.



Horizontal: 2 msec/div.
 Vertical: 0.1 V/div.

Fig. 6-4-1

*Adjustment procedure when the alignment cassette (VJ-0113) is not available.
 Adjust VR1503 and VR1502 until any "flicker" or "FM inversion: black noise" disappear.

2. Dropout Compensator Sensitivity

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1501	TV screen	Alignment cassette (VJ-0077)	PLAY mode

a. Load the alignment cassette (VJ-0077), and the VCR to the PLAY mode.
 b. Turn VR1501 completely to the left (when seen from the parts side).
 c. Next, turn VR1501 slowly back to the right to adjust the non-compensation portion so that it is 0.8 ~ 1.0 colour bar.

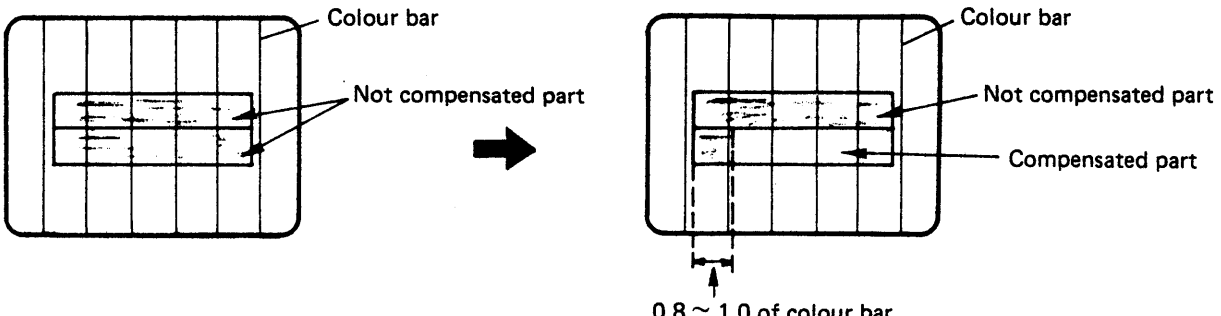


Fig. 6-4-2

* Adjustment procedure when the dropout adjustment tape (VJ-0077) is not available.
 a. Playback a tape that has a lot of dropout.
 b. Adjust VR1501 until dropout is compensated for.

3. Recording Amplifier Frequency Response

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1505	TP1502 TP1501	Oscilloscope Colour-bar generator	REC mode

a. Set VR1505 to the centre position.
 b. Input a colour-bar signal which includes a 100% white signal and set the VCR to the REC mode.
 c. Connect the oscilloscope to TP1502, and then connect TP1501 to earth.
 NOTE: Because TP1501 is Vcc (+ 9V), be sure not to connect it to the earth of the VCR chassis.
 d. Adjust VR1505 so that the waveform becomes flat.

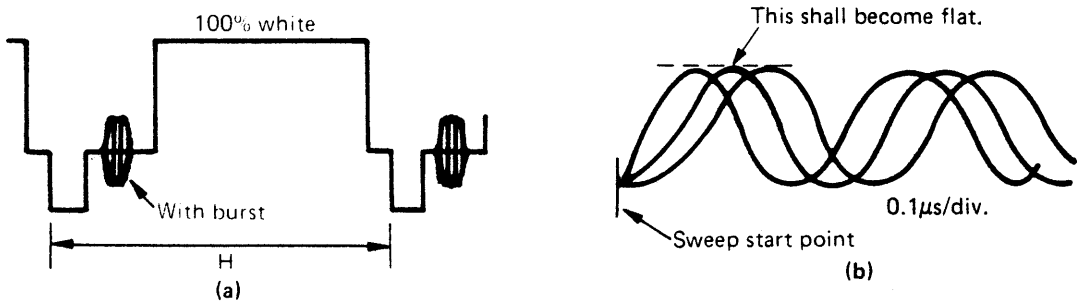
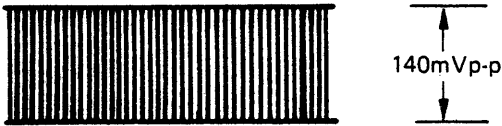


Fig. 6-4-3

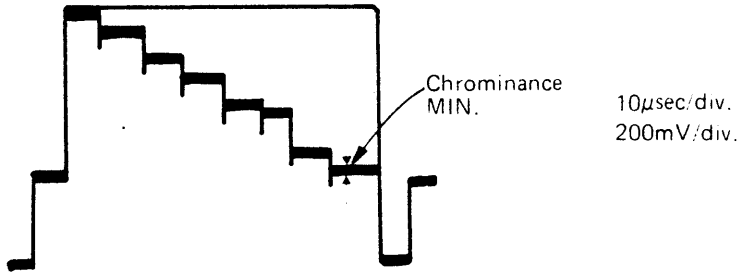
4. Recording Current

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1504	TP1502 TP1501	Oscilloscope Colour-bar generator	REC mode
a. Input a black-and-white signal containing a 100% white signal and set the VCR to the REC mode. b. Connect the oscilloscope to TP1502, and then connect TP1501 to earth. c. Adjust VR1504 so that it is $140 \pm 10\text{mVp-p}$.			
			
Fig. 6-4-4			

[ADJUSTMENTS FOR LUMINANCE SYSTEM]

(Refer to Fig. 6-4-11 VD-1 circuit board)

1. 4.43-MHz Trap

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
T1001	Pin (16) of IC1001 [Pin (3) of DL1001]	Oscilloscope Colour-bar generator	EE mode
a. Input a colour-bar signal (EE colour-bar signal) which contains a 100% white signal. b. Connect the oscilloscope to pin (16) of IC1001. c. Adjust T1001 so that the chrominance component is minimized.			
			
Fig. 6-4-5			

2. SYNC AGC and Peak AGC

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1005 VR1004	Pin (6) of S1006 JP1001	Oscilloscope Colour-bar generator	EE mode
a. Connect the colour-bar generator to pin (6) of S1006. b. Input a colour-bar signal which contains a 100% white signal. c. Connect the oscilloscope to JP1001. d. Adjust VR1005 so that it is $0.76 \pm 0.02\text{Vp-p}$. (Sync AGC) e. Adjust VR1004 so that it is $0.80 \pm 0.05\text{Vp-p}$. (Peak AGC)			

3. EE Level Adjustment

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1001	JP1005	Oscilloscope Colour-bar generator	EE mode
a. Input a colour-bar signal which contains a 100% white signal. b. Connect the oscilloscope to JP1005. c. Open the video output terminal. d. Adjust VR1001 to $2.0 \pm 0.1\text{Vp-p}$.			

4. Compressor

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1003	JP1002	Digital voltmeter	EE mode
a. Connect the digital voltmeter to JP1002. b. Adjust VR1003 to $\text{DC } 1.05 \pm 0.05\text{V}$.			

5. Deviation

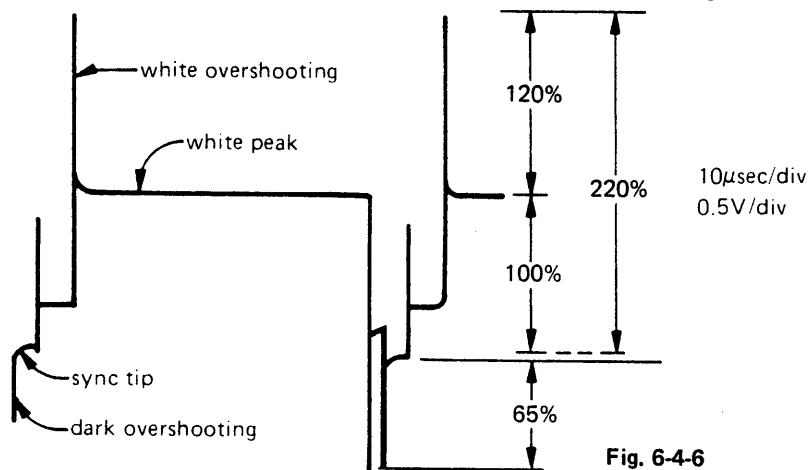
Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1008	Video JP1003	Oscilloscope Colour-bar generator Alignment cassette. (VJ-0113)	EE mode
a. Load the alignment cassette and playback the colour-bar signal. b. Connect the oscilloscope to JP1003. c. Playback level confirm so that is $2.0 \pm 0.1\text{Vp-p}$. d. Input a colour-bar signal which contains a 100% white signal. It is recording and playback. e. Adjust VR1008 so that is $2.0 \pm 0.1\text{Vp-p}$. At this time, open the video output terminal.			

6. Carrier Frequency Setting

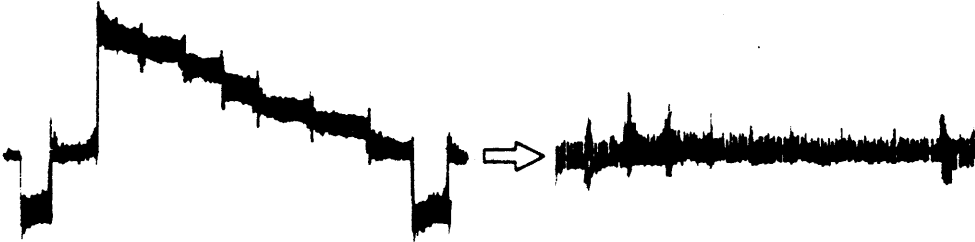
Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1002	JP1003	Frequency counter	EE mode
a. Input a non-input signal so that the VCR is set to the EE mode. b. Connect the frequency counter to JP1003. c. Adjust VR1002 to be 3850 kHz $\pm$ 50 kHz.			

7. White Clip and Dark Clip

Adjustment location	Measurement poin	Measurement equipment	Adjustment condition
VR1006 VR1007	JP1004	Oscilloscope Colour-bar generator	EE mode
a. By means of a signal generator, input a signal containing a large high-frequency component such as a monoscope or Phillips pattern. b. Connect the oscilloscope to JP1004. c. Adjust VR1006 so that, supposing that the interval between the sync tip and the white peak is 100%, the interval between the sync tip and the white overshoot becomes 220 $\pm$ 10%. d. Adjust VR1007 so that the interval the sync tip and the dark overshooting becomes 65 $\pm$ 5%.			



8. Y System Comb Noise Canceller

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1011	JP1006	Oscilloscope Alignment cassette (VJ-0113)	PLAY mode
a. Load the alignment cassette (VJ-0113) and playback the colour-bar signal. b. Connect the oscilloscope to JP1006 and observe the waveform in the H (horizontal) period. c. Adjust VR1011 so that the video signal is cancelled and only the noise component remains.			
			
Fig. 6-4-7			

9. Expander

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1009	JP1007	Digital voltmeter	PLAY mode
a. Connect the digital voltmeter to JP1007. b. Adjust VR1009 to $DC\ 1.0 \pm 0.05V$.			

10. Playback Level

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1010	JP1005	Oscilloscope Alignment cassette (VJ-0113)	PLAY mode
a. Load the alignment cassette (VJ-0113) and playback the colour-bar signal. b. Connect the oscilloscope to JP1005. c. Adjust VR1010 to $2.0 \pm 0.1V_{p-p}$.			

[ADJUSTMENT FOR CHROMA SYSTEM] (Refer to Fig. 6-4-11 VD-1 circuit board)

1. VCO Free Oscillation Frequency

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VC1001	JP1011 JP1012	Frequency counter	PLAY mode
a. Input a non-input signal and the VCR to the PLAY mode. b. Input DC +6V to JP1011. c. Connect the frequency counter to JP1012. d. Adjust VR1001 so that the counter display reads 687.5 ± 9 kHz.			

2. Comb Filter

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
T1009 VR1016	—	Alignment cassette (VJ-0113)	PLAY mode
a. Load the alignment cassette and playback the colour-bar signal. b. Alternately adjust VR1016 and T1009 until crosstalk (a black striped pattern) disappears on the monitor screen.			

3. Reference Oscillation Frequency

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
T1007	JP1014	Frequency counter	PLAY mode
a. Input a non-input signal and set the VCR to PLAY mode. b. Connect the frequency counter to JP1014. c. Adjust T1007 to $4.433619 \text{ MHz} \pm 20 \text{ Hz}$.			

4. VXO Free Oscillation Frequency

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
T1008	JP1014	Frequency counter Colour-bar generator	EE mode
a. Input a white (100%) or black (0%) signal. At the time, burst signal is nothing. b. Connect the frequency counter to JP1014. c. Adjust T1008 to $4.433619 \text{ MHz} \pm 30 \text{ Hz}$.			

5. Burst Tuning

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
T1006	JP1015	Oscilloscope Colour-bar generator	EE mode
a. Input the colour-bar signal, and set the VCR to the EE mode. b. Connect the oscilloscope to JP1015. c. Adjust T1006 so that the DC level is maximized.			

6. ACC Setting

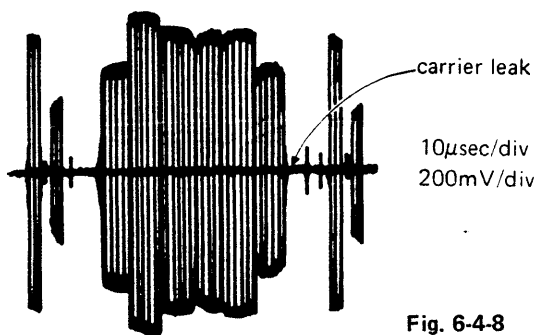
Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1014	JP1016	Oscilloscope Colour-bar generator	EE mode
a. Input the colour-bar signal and connect the oscilloscope to JP1016. b. Adjust VR1014 so that it is $750 \pm 30\text{mVp-p}$.			

7. Idler Band Pass Filter (5.12-MHz B.P.F.)

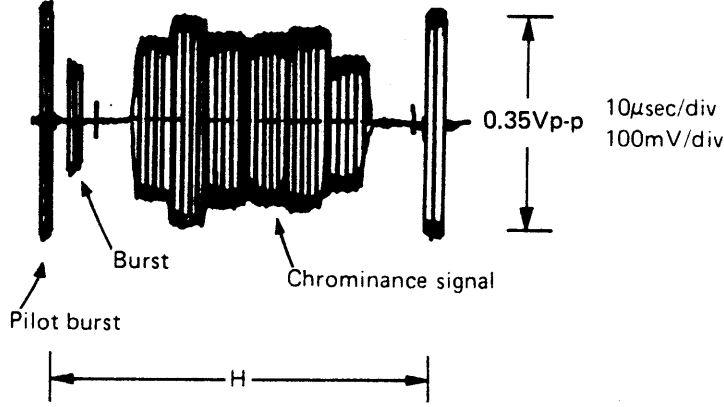
Adjustment location	Measurement point	Measurement equipment	Adjustment condition
T1010 T1011	JP1017	Oscilloscope Colour-bar generator	EE mode
a. Input the colour-bar signal. b. Connect the oscilloscope to JP1017. c. Alternately adjust T1010 and T1011 so that the waveform becomes a well-shaped sine wave and the amplitude of the waveform is maximized.			

8. Carrier Leak Offset

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1012	JP1018	Oscilloscope Colour-bar generator	EE mode
a. Input the colour-bar signal and set the VCR to the EE mode. b. Connect the oscilloscope to JP1018. c. Adjust VR1012 so that the carrier leak is minimized.			



9. Chrominance Recording Current

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1015	JP1019	Oscilloscope Colour-bar generator	EE mode
a. Input the colour-bar signal and set the VCR to the EE mode. b. Connect the oscilloscope to JP1019. c. Adjust VR1015 to $0.35 \pm 0.05\text{Vp-p}$.			
 Fig. 6-4-9			

10. Pilot Burst Signal Level

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
—	JP1019	Oscilloscope Colour-bar generator	EE mode
a. Input the colour-bar signal and connect the oscilloscope to JP1019. b. Confirm that the pilot burst level and chrominance level is became equivalent. c. Confirm that the pilot burst is within the H-sync (horizontal synchronizing signal) and that the phase of the chrominance signal is locked.			

11. APC Offset

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR1017	JP1011 JP1020	Oscilloscope Alignment cassette (VJ-0113)	PLAY mode

- Load the alignment cassette (VJ-0113) and playback the colour-bar signal.
- Connect the oscilloscope to JP1011.
- Connect the trigger pulse for waveform observation to JP1020 (RF switching pulse).
- Adjust VR1017 so that the level difference between the waveform of channel A and that of channel B becomes 0.

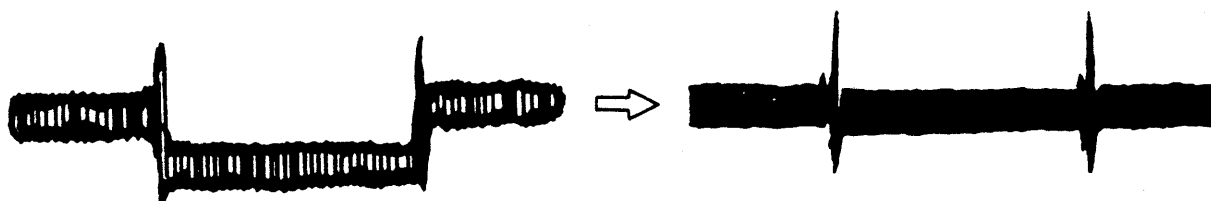


Fig. 6-4-10

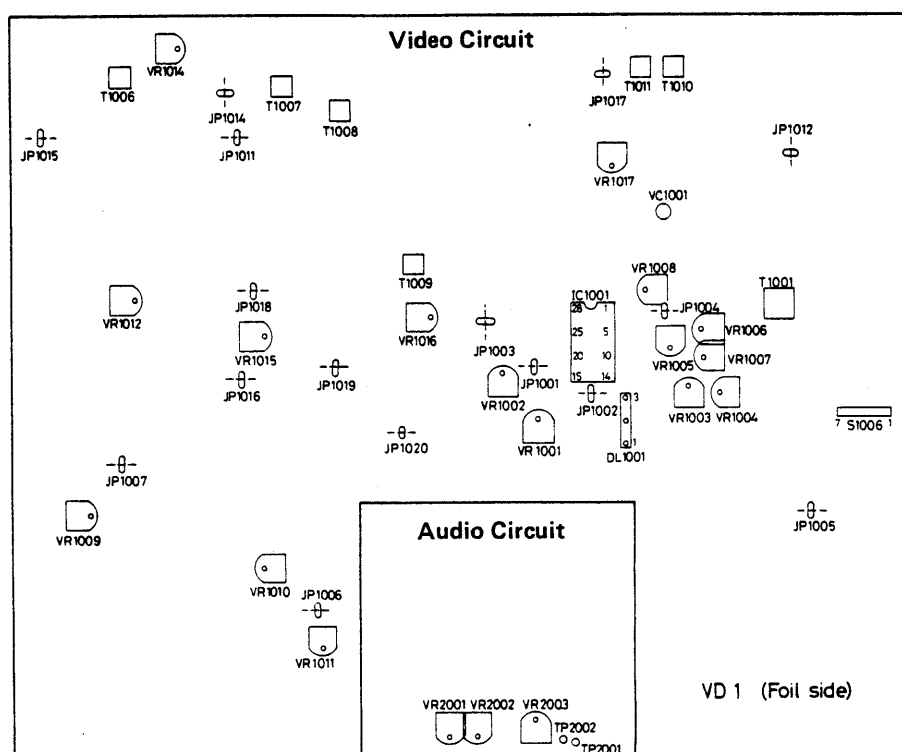
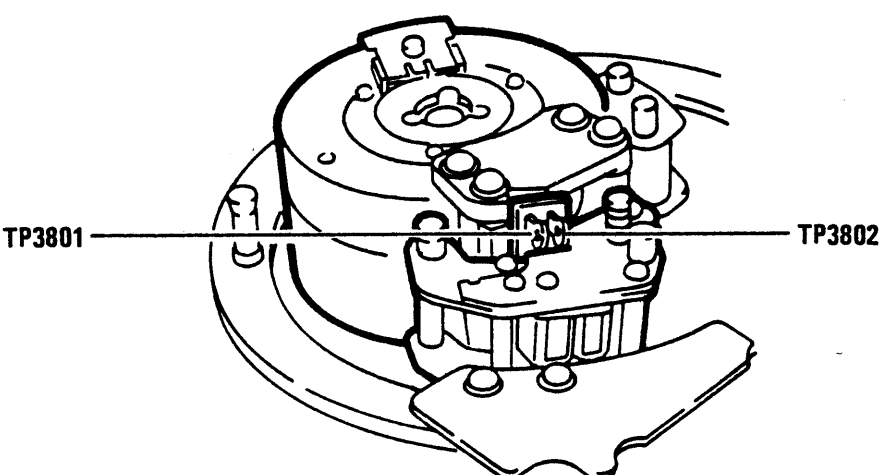


Fig. 6-4-11 VD-1 Circuit board (Video and Audio)

E. AUDIO CIRCUIT (VD-1 CIRCUIT BOARD) (Refer to Fig. 6-4-11.)

1. Bias Current

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR2003 L2005	TP3801 (hot) TP3802 (earth)	Vacuum-tube voltmeter Video cassette	REC mode
a. Load a video cassette, and then set the VCR to the REC mode with no signal. (The input signal can be cut out by simply connecting a blank plug to the audio input terminal.) b. Connect the vacuum-tube voltmeter to TP3802 (earth) and TP3801 (hot) of the MC-8 circuit board. c. Adjust VR2003 to 17mV (170μA).			
 Fig. 6-5-1			

2. Recording Current

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR2001	TP3801 (hot) TP3802 (earth)	Vacuum-tube voltmeter Audio frequency oscillator Video cassette	REC mode
a. Load a video cassette, and then set the VCR to the REC mode. b. Short circuit base of TP2001 and TP2002 of the VD-1 circuit board (audio circuit) so that oscillation is stopped. c. Connect the audio frequency oscillator to the audio input terminal of the VCR, and set the output of the oscillator to 1 kHz, -10dBm (0.25Vrms). d. Connect the vacuum-tube voltmeter to TP3802 (earth) and TP3801 (hot) of the MC-8 circuit board. e. Adjust VR2001 so that the recording current is 30μArms (3.0 mV).			

3. Playback Equalizer and Overall Frequency Response

Adjustment location	Measurement point	Measurement equipment	Adjustment condition
—	Audio output terminal	Oscilloscope Audio frequency oscillator Video cassette	REC mode PLAY mode

a. Load a video cassette, and then set the VCR to the REC mode.
 b. Connect the audio frequency oscillator to the audio input terminal of the VCR and set the oscillator output to 333 Hz, -40dBm.
 c. Record the 333-Hz signal for approximately 10 seconds. In the same manner, record each signal of 50 Hz, 1 kHz, 6 kHz, 7 kHz, and 8 kHz.
 d. Connect the oscilloscope to the audio output terminal, and then set the VCR to the PLAY mode.
 e. Confirm that the output for 50 Hz, 100 Hz, 5 kHz, 7 kHz, and 10 kHz are all within the standard values given below.
 Note: When varying from this level, there is a malfunction in either a circuit or in the tape travel somewhere, please check.

The graph shows the frequency response of the playback equalizer. The y-axis represents the gain in dB, ranging from -12dB to 4dB. The x-axis represents the frequency in Hz, with markers at 50Hz, 333Hz, 1KHz, 5KHz, 6KHz, and 8KHz. A solid line indicates the measured response, while dashed lines show the standard deviation levels. The response is flat at 0dB for frequencies between 333Hz and 5KHz. It rises to 3dB at 50Hz and falls to -12dB at 8KHz.

Fig. 6-5-2

4. Recording and Playback Output Levels

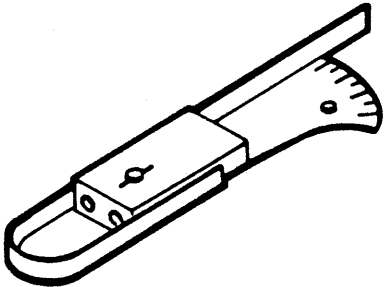
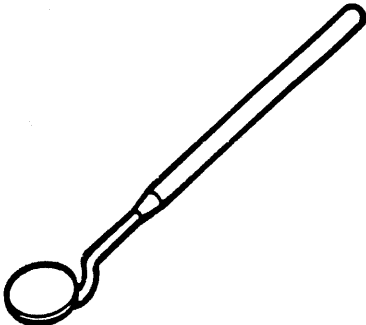
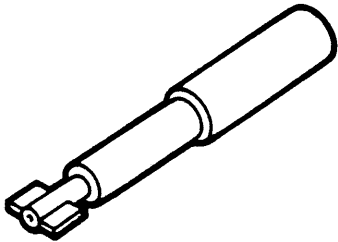
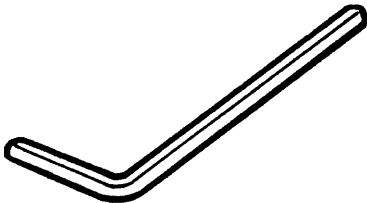
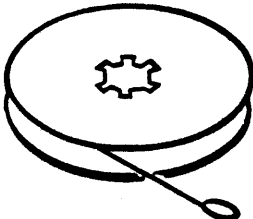
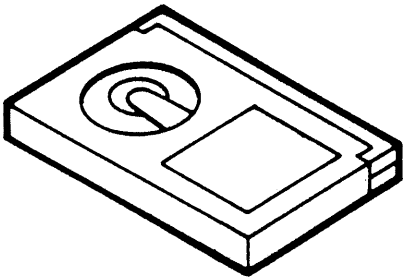
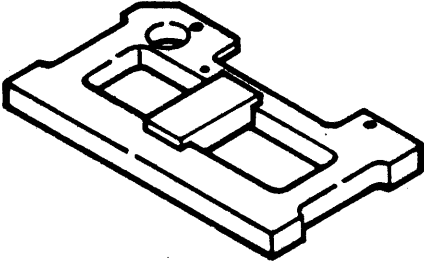
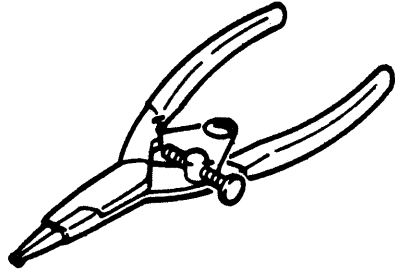
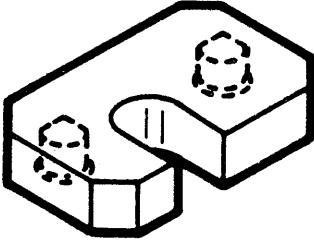
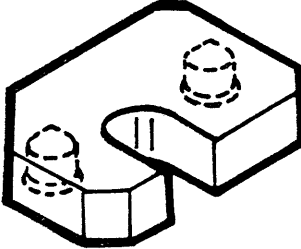
Adjustment location	Measurement point	Measurement equipment	Adjustment condition
VR2002	AUDIO OUT	Vacuum-tube voltmeter Audio frequency oscillator Video cassette	REC mode PLAY mode

a. Load a cassette, and then set the VCR to the REC mode.
 b. Connect the audio frequency oscillator to the audio input terminal of the VCR and set the oscillator output to 1 kHz, -10dBm.
 c. Connect the vacuum-tube voltmeter to the audio output terminal, wait until the EE mode output stabilizes, and then change from the REC mode to the PLAY mode.
 d. Adjust VR2002 so that the playback output is equivalent to that of the EE mode.

VII. MECHANISM ADJUSTMENTS

A. JIGS AND TOOLS FOR ADJUSTMENT

No.	Names	Jig. No.	Remarks
1	Spring tension gauge (100 gram)	VJ-0012	Measurement for FWD (PLAY), R-SEARCH take-up torque
2	Spring tension gauge (500 gram)	VJ-0014	Measurement for F FWD, REW take-up torque
3	Inspection mirror	VJ-0015	Tape path alignment
4	Eccentric screwdriver	VJ-0017	Tape path alignment
5	Hexagonal wrench (M3)	VJ-0022	Adjustment of back tension guide
6	Tension gauge for reel	VJ-0038	Measurement for all winding torque
7	Alignment tape	VJ-0061	Tape path alignment
8	Cassette stand plate gauge	VJ-0105	Adjustment of reel height
9	Hexagonal wrench (M2.6)	VJ-0108	Installation of reel motor pulley
10	Grip ring pincher	VJ-0109	For attaching/detaching grip ring
11	Position adjustment gauge	VJ-0120	Adjustment of back tension guide
12	Checker adjustment gauge	VJ-0121	Adjustment of back tension guide

VJ-0012 VJ-0014  No. 1, No. 2	VJ-0015  No. 3	VJ-0017  No. 4
VJ-0022  No. 5	VJ-0038  No. 6	VJ-0061  No. 7
VJ-0105  No. 8	VJ-0108  No. 9	VJ-0109  No. 10
VJ-0120  No. 11	VJ-0121  No. 12	

B. PREPARATIONS FOR ADJUSTMENTS

1. REMOVAL OF THE CASSETTE COVER

Remove the cassette cover as explained in section IV. CABINET DISASSEMBLY.

2. REMOVAL OF THE VEIL (See Fig. 7-2-1.)

Remove the veil by removing the screw (a).

3. REMOVAL OF THE CASSETTE HOLDER (See Fig. 7-2-2.)

(1) Detach the E-rings from the left and right cassette holder links and disconnect the links from the cassette holder.

(2) Remove the spring which is attached to the cassette holder and the right link.

(3) Bring the cassette holder down in the direction of arrow A, and separate the groove in the cassette holder from the left-to-right clearance adjusting screw.

(4) Slide the cassette holder to the left, and detach the cassette holder shaft from the right cassette stand.

(5) Slant the cassette holder to the right, detach the cassette holder shaft from the left cassette stand, and remove the cassette holder.

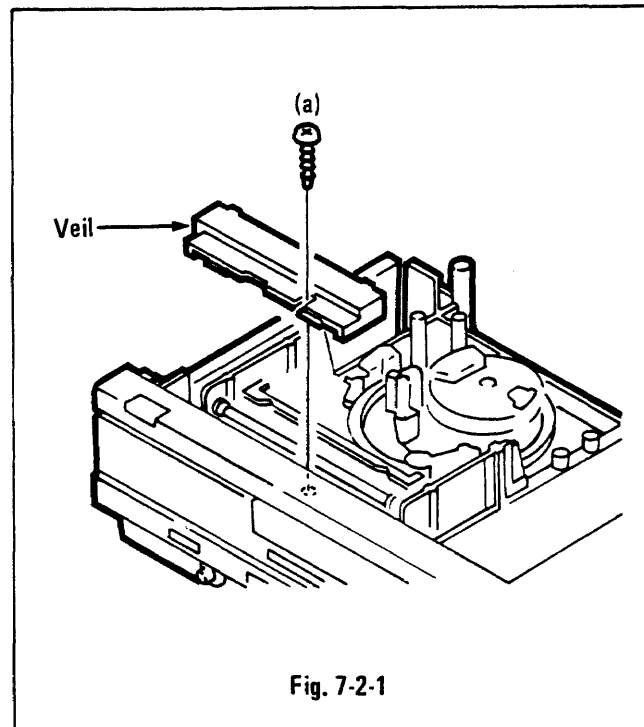


Fig. 7-2-1

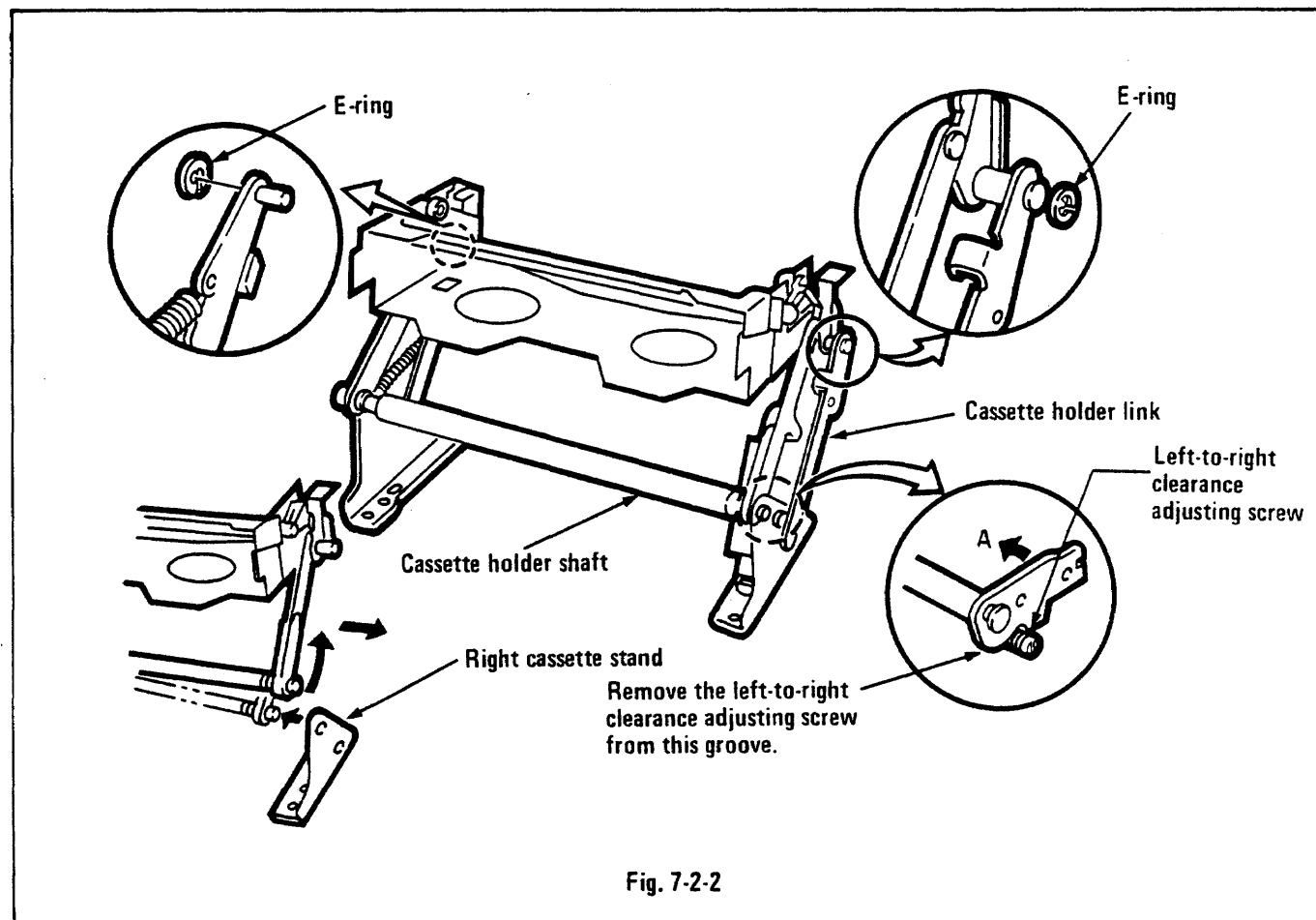
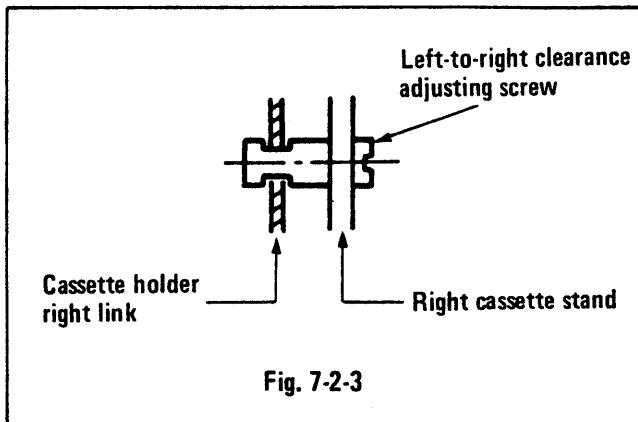


Fig. 7-2-2

[Notes regarding installation] (See Fig. 7-2-3.)

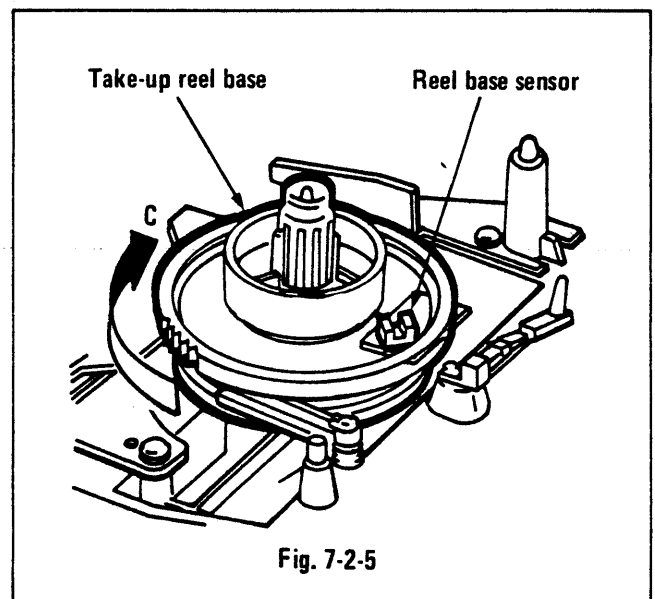
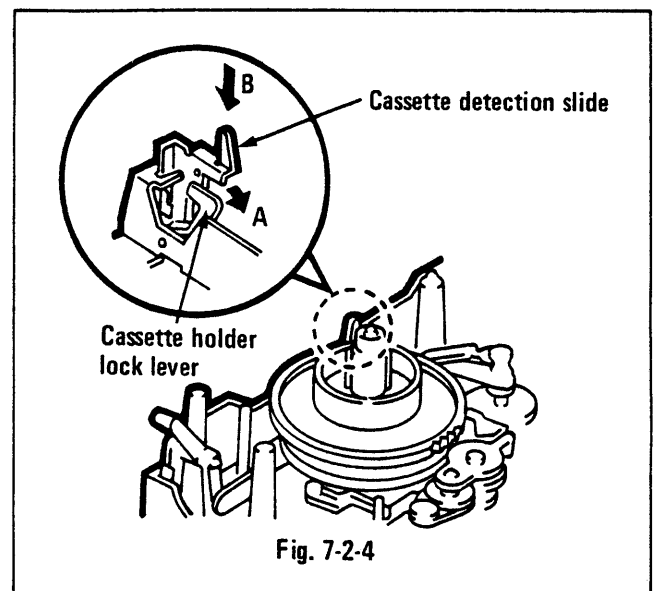
Installation can be done by carrying out items 1 ~ 3 of the removal procedure in reverse order; however, note the following:

- (1) Be sure that the groove in the cassette holder is firmly seated on the left-to-right clearance adjusting screw. (See Fig. 7-2-3.)
- (2) Do not loosen the left-to-right clearance adjusting screw or the securing screws of the right cassette holder link.



4. OPERATION OF THE VCR ONCE THE CASSETTE HOLDER HAS BEEN REMOVED (See Figs. 7-2-4, 7-2-5.)

- (1) Turn on the power.
- (2) While pressing the cassette holder lock lever in the direction of arrow A, press the cassette detection slide in the direction of arrow B.
- (3) The mode will change in accordance with the operation button which is pressed.
- (4) In both the REW and R-SEARCH modes, the safety mechanism will function if the take-up reel base does not rotate, therefore, manually rotate the take-up reel base clockwise (direction C). (See Fig. 7-2-5.)



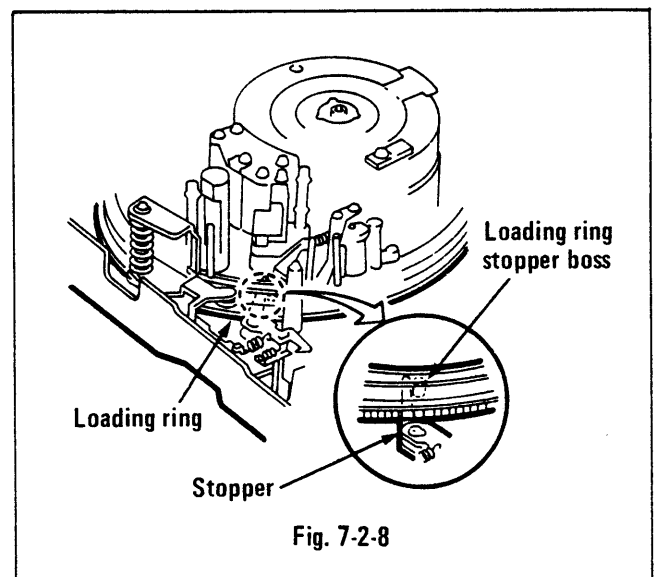
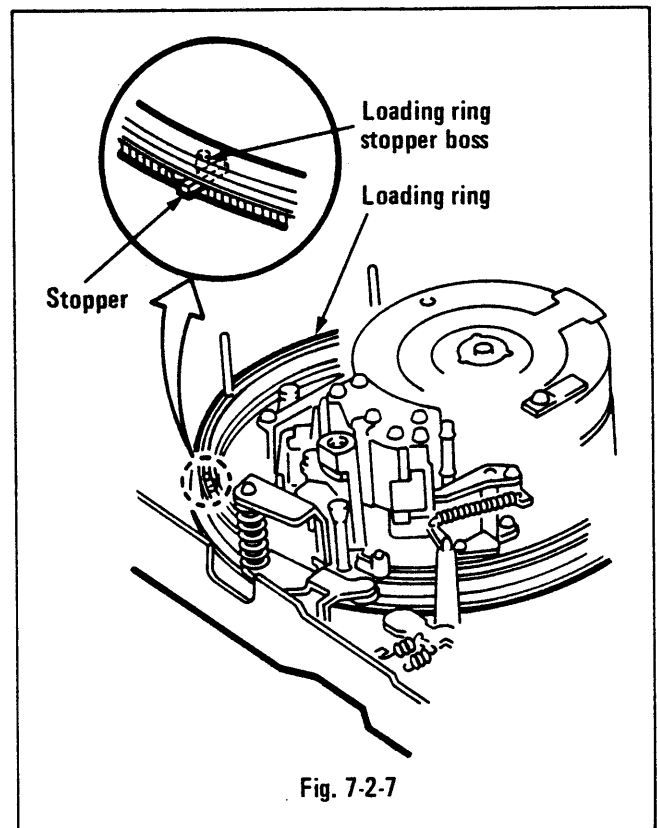
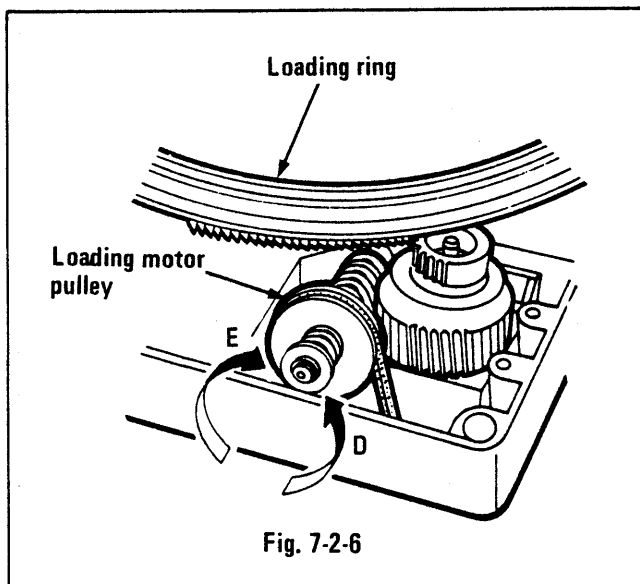
[Manual rotation of the loading ring] (See Figs. 7-2-6, 7-2-7, 7-2-8.)

(1) To load, manually rotate the loading motor pulley in the direction of arrow D, and the loading ring will rotate counter clockwise.

(2) At the completion of the loading condition, the loading ring stopper will function to stop the loading ring rotation. (See Fig. 7-2-7.)

(3) To unload, manually rotate the loading motor pulley in the direction of arrow E, and the loading ring will rotate clockwise.

(4) At the completion of the unloading condition, the loading ring stopper will function to stop the loading ring rotation. (See Fig. 7-2-8.)



C. MAINTENANCE TIMETABLE

Parts \ Time (Hours)	500	1000	1500	2000	2500	3000	3500	4000	5000
Video head	△	△	△	△	△	△	△	△	△
Audio/control head	△	△	△	△	△	△	△	△	△
Pinch roller	△	△	△	△	△	△	△	△	△
Full erase head	△	△	△	△	△	△	△	△	△
Supply reel base				▲				▲	
Take-up reel base				▲				▲	
PLAY gear		▲		▲		▲		▲	
F FWD/REW roller		▲		▲		▲		▲	
Center gear		▲		▲		▲		▲	

△ Cleaning methyl alcohol
 ▲ Lubrication specified lubricant

D. MECHANISM REPAIR AND PARTS REPLACEMENT

Before replacing any of the following parts, be sure to turn off the power [set the power switch to the "STAND BY" position or pull out the power cord from the outlet].

- * Video head drum
- * Video head
- * Audio/control head
- * Full-erase head
- * Micro switches (cassette-in, loading I, loading II, erasure prevention)
- * Reel motor
- * Capstan motor
- * Loading motor
- * Tape end sensors (FWD, REW)
- * DEW sensor
- * Reel base sensor

(Caution)

Be especially sure that the power is off [the power switch is in the "STAND BY" position] when connecting or disconnecting the connectors of the video head drum and of the capstan motor. If one of these connectors is connected or disconnected while the power is on [the power switch is in the "ON" position] the internal ICs will be damaged.

1. VIDEO HEAD (See Fig. 7-4-1.)

- (1) Turn off the power. [Set the power switch to the "STAND BY" position.]
- (2) Move the video head drum to a position at which the video heads are easy to clean.
- (3) Wipe each head several times with the deerskin part of the head cleaning stick. If the heads are extremely dirty, wipe more times.

(Note)

Note that the two video heads are located directly opposite each other on the video head drum.

(Caution)

- * When pressing a finger on the head cleaning stick to clean the heads, do not press too hard.
- * Do not move the head cleaning stick up and down against the video heads; doing so will damage the heads.

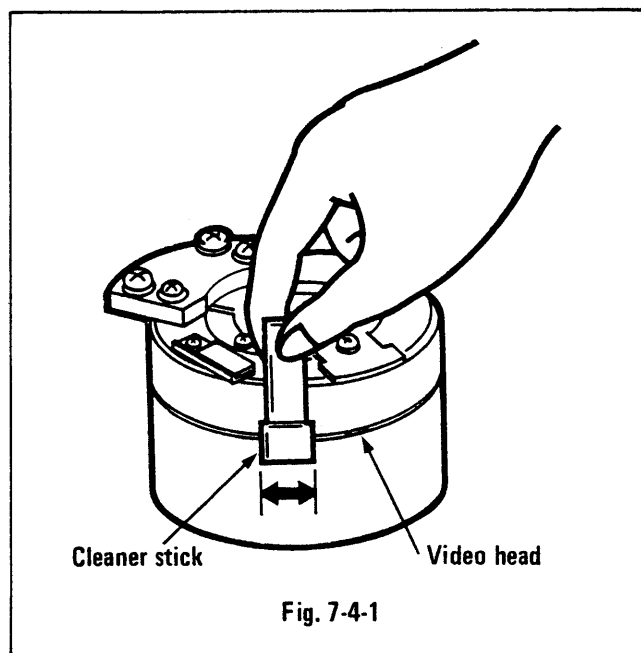


Fig. 7-4-1

2. CLEANING THE AUDIO/CONTROL HEAD AND FULL-ERASE HEAD (See Figs. 7-4-2, 7-4-3.)

Apply alcohol to the cleaning stick, and move the cleaning stick against the heads in the direction of the head gap.

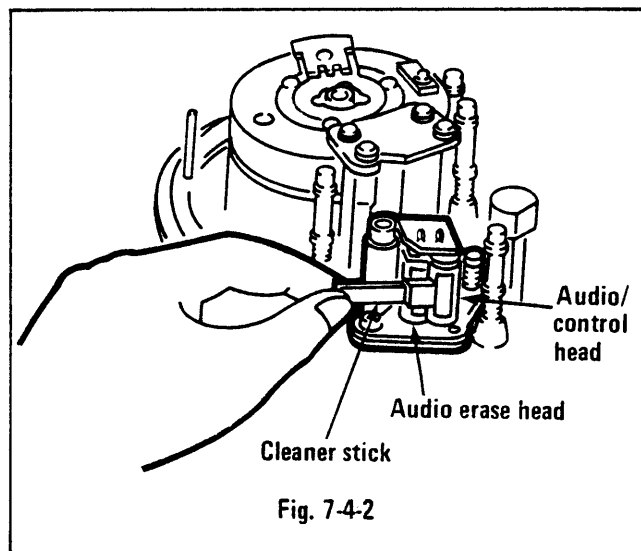
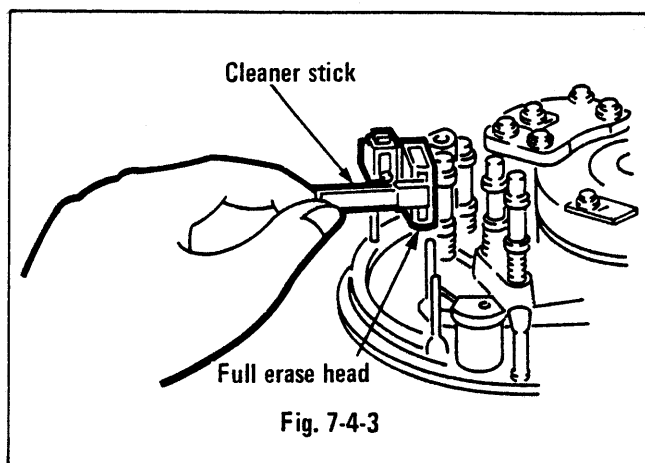
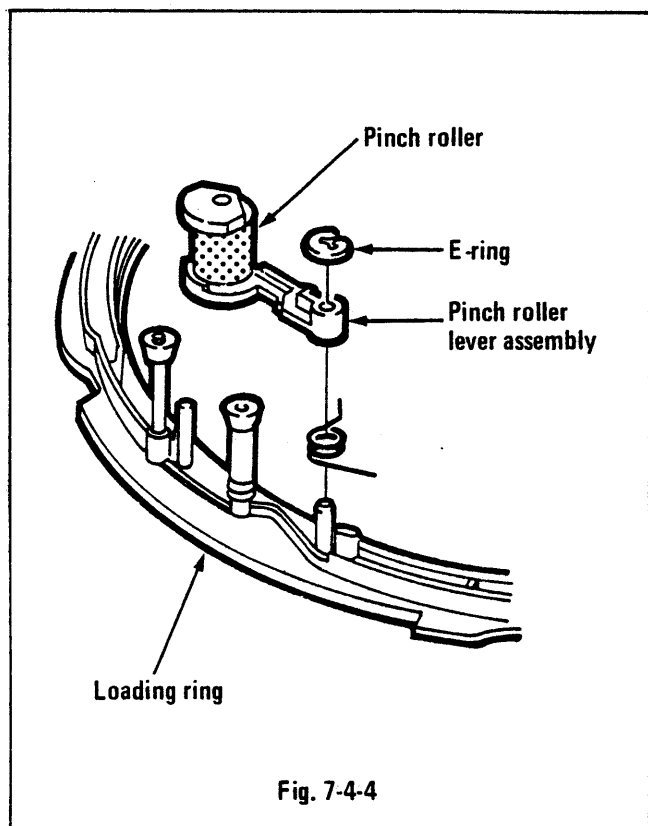


Fig. 7-4-2



3. PINCH ROLLER (See Fig. 7-4-4.)

- (1) Using a soft cloth moistened with alcohol, clean the surfaces of the pinch roller.
- (2) If there are scratches on the pinch roller, remove the E-ring and replace the pinch roller lever assembly.



4. TAPE PATH

Clean the surfaces of the tape guides and the drum tape path by using a soft cloth or cleaning stick moistened with a alcohol.

(Caution)

When cleaning the drum surfaces, be careful not to contact the video heads.

5. SUPPLY REEL BASE (See Fig. 7-4-5.)

- (1) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)
- (2) Remove the washers holding the supply reel base.
- (3) Turn the ratchet brake in the direction of arrow A.
- (4) While pressing the mode select slide in the direction of arrow B, remove the supply reel base.

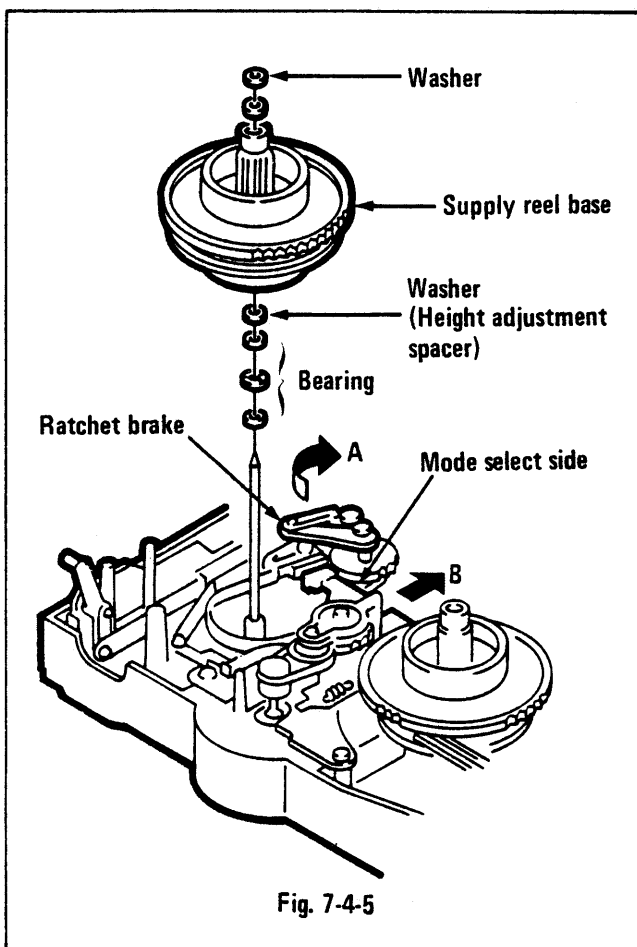
(Caution)

Be careful not to lose the height adjustment spacer.

- (5) Wipe off the old oil from the reel shaft by using a cloth moistened with alcohol, and then apply a small amount of new oil.

- (6) While pressing the mode select slide in the direction of arrow B, install the supply reel base. If a new supply reel base is being installed, adjust the reel base height. (Refer to item "E. ADJUSTMENTS, 1. REEL BASE HEIGHT".)

- (7) Mount the washers, and then install the cassette holder.



6. TAKE-UP REEL BASE (See Fig. 7-4-6.)

(1) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(2) Remove the washers holding the take-up reel base.

(3) While pressing the mode select slide in the direction of arrow A and the take-up reel soft brake in the direction of arrow B, remove the take-up reel base.

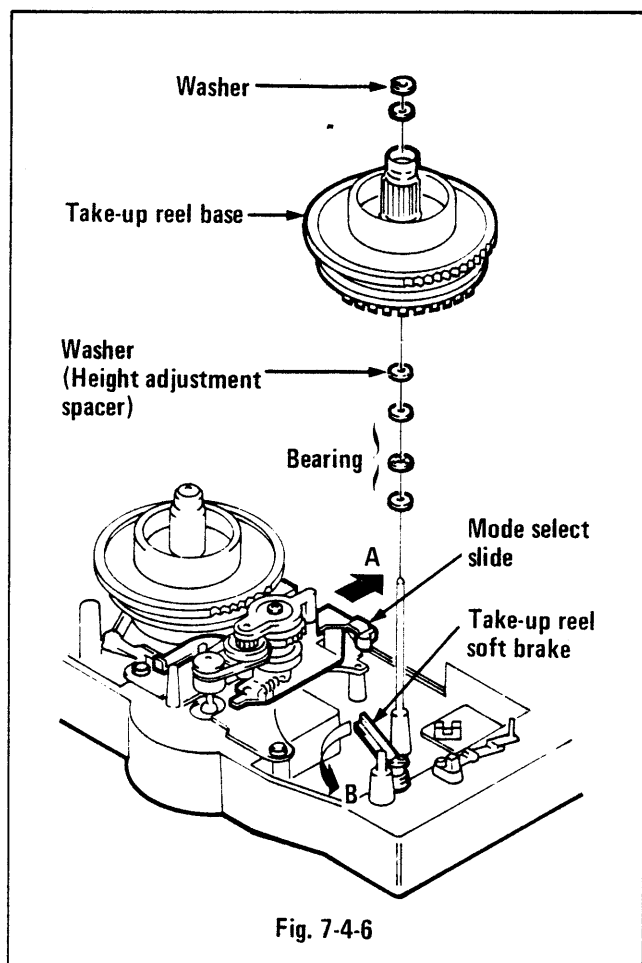
(Caution)

Be careful not to lose the height adjustment spacer.

(4) Wipe off the old oil from the reel shaft by using a cloth moistened with alcohol, and then apply a small amount of new oil.

(5) While pressing the mode select slide in the direction of arrow A and the take-up reel soft brake in the direction of arrow B, install the take-up reel base. If a new take-up reel base is being installed, adjust the reel base height. (Refer to item "E. ADJUSTMENTS, 1. REEL BASE HEIGHT".)

(6) Mount the washers, and then install the cassette holder.



7. REEL BASE DRIVE GEAR ASSEMBLY (See Fig. 7-4-7.)

(1) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(2) Remove the supply reel base. (Refer to item "5. SUPPLY REEL BASE".)

(3) Remove the take-up reel base. (Refer to item "6. TAKE-UP REEL BASE".)

(4) Remove the screw (a) which secures the ratchet brake, and then remove the brake.

(5) Remove the reel motor belt.

(6) Remove the screws (b) which secure the reel base drive gear assembly, and then remove the assembly.

(7) Remove the E-ring, and then remove the center gear and the F FWD/REW lever. Next, remove the washers, and then remove the play gear and the F FWD/REW roller.

(8) Clean the support shaft of the F FWD/REW lever, center gear, and play lever, and also the shaft of the F FWD/REW roller and play gear by using a cloth moistened with alcohol, and then apply a small amount of new oil.

(9) Install the play gear, the F FWD/REW roller, the play lever, the center gear, and the F FWD/REW lever by reversing the removal procedure.

(10) Install the reel base drive gear assembly. The prong on the end of the mode select slide should fit into the hole in the mode select lever.

(11) Install the reel motor belt.

(Caution)

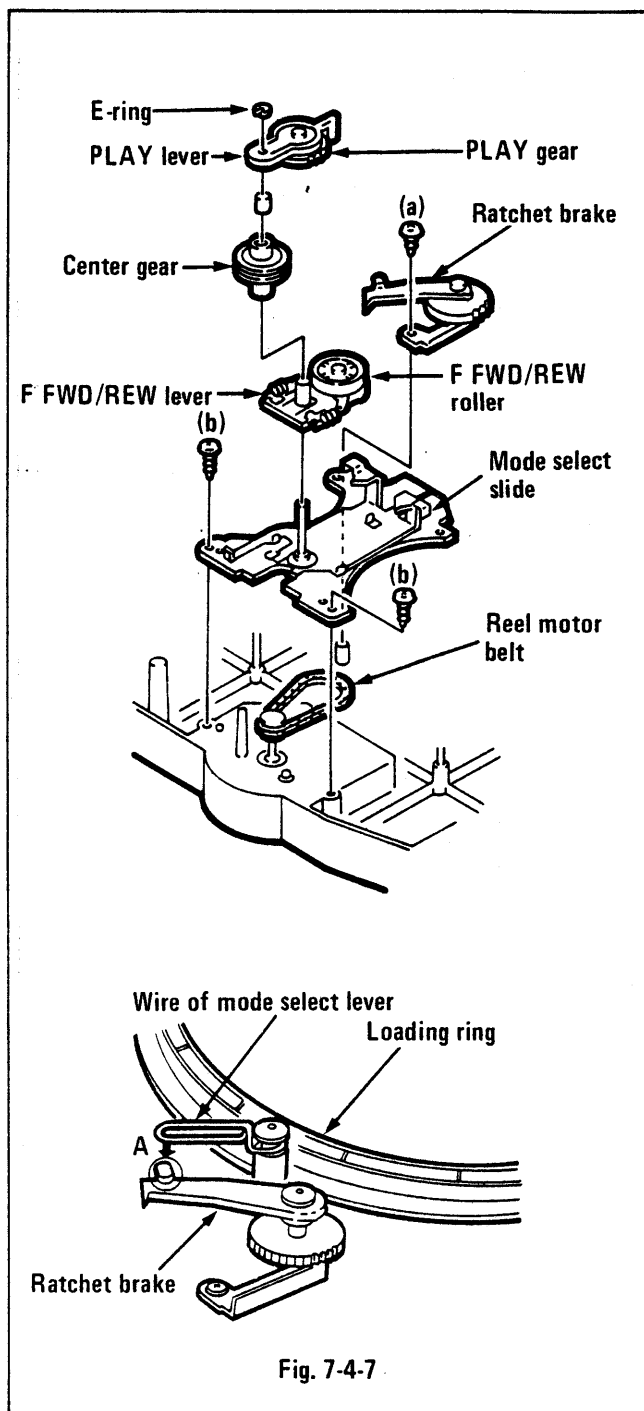
Be sure that the belt is not twisted, and be careful that oil does not get on the belt.

(12) Install the ratchet brake. Part A of the ratchet brake should be in contact with the wire of the mode select lever.

(13) Install the supply reel base, the take-up reel base, and the cassette holder.

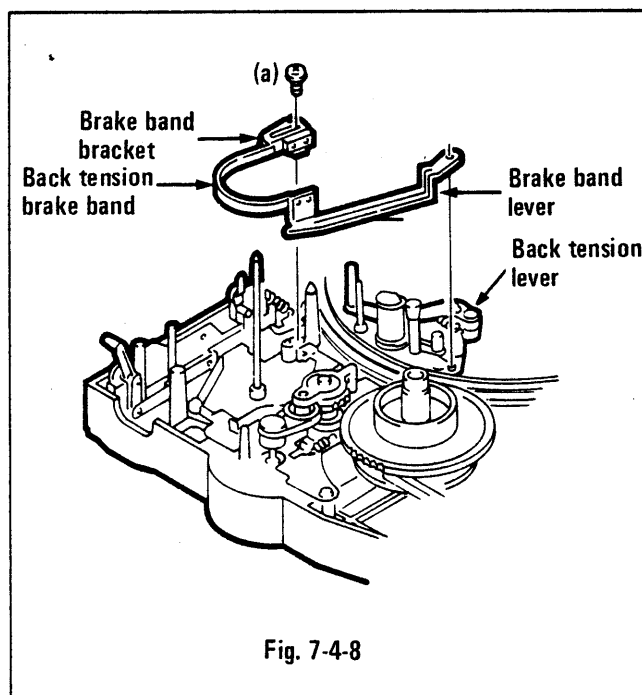
(Caution)

The reel base drive gear assembly should be disassembled for cleaning and lubrication only.



8. BACK TENSION BRAKE BAND (See Fig. 7-4-8.)

- (1) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)
- (2) Remove the supply reel base. (Refer to item "5. SUPPLY REEL BASE".)
- (3) Remove the reel base drive gear assembly. (Refer to item "7. REEL BASE DRIVE GEAR ASSEMBLY".)
- (4) Disconnect the brake band lever from the back tension lever.
- (5) Remove the screw (a) which holds the brake band bracket.
- (6) Remove the back tension brake band by passing the brake band lever under the loading ring.
- (7) Install the new brake band by reversing the removal procedure.
- (Caution)
Be careful not to crease or scratch the new brake band.
- (8) Install the reel base drive gear assembly.
- (9) Install the supply reel base.
- (10) Adjust the position of the back tension lever. (Refer to item "E. ADJUSTMENTS, 1. REEL BASE HEIGHT".)
- (11) Install the cassette holder.



9. AUDIO/CONTROL HEAD (See Fig. 7-4-9.)

(1) Remove the screws (a, b) which hold the audio/control head assembly, and then remove the soldered lead wire.

(2) Install the new audio/control head assembly.

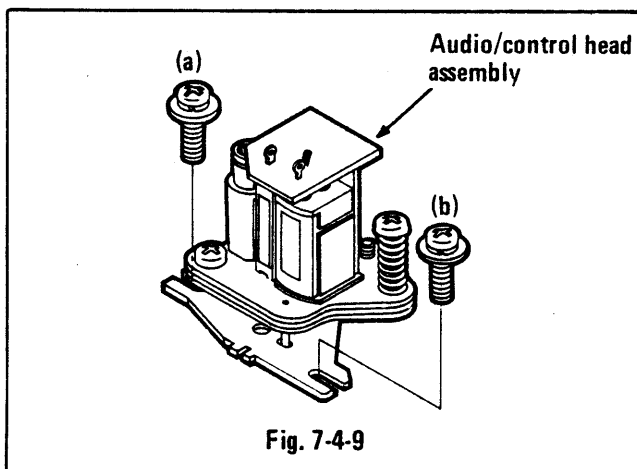
(Caution)

Be careful to solder the lead wire at the correct position.

(3) Adjust the tape path. (Refer to item "F. TAPE PATH ADJUSTMENTS".)

(Note)

Play the service alignment tape (VJ-0061) or a previously recorded tape; if the playback is normal, adjustment is not necessary.



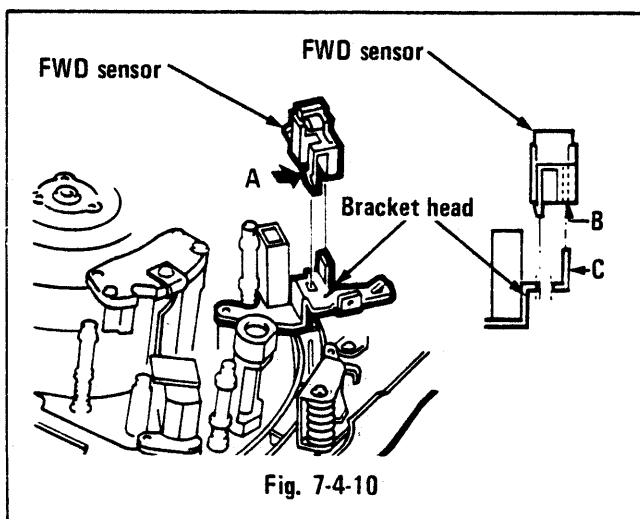
10. FWD SENSOR (See Fig. 7-4-10.)

(1) Remove the lead wire soldered to the FWD sensor.

(2) While pressing part A of the FWD sensor in the direction of the arrow, remove the sensor by lifting it upward.

(3) Install the new FWD sensor.

(4) When doing the installation, fit the hole (B) of the FWD sensor onto the prong (C) of the bracket head, and press downward.



11. REW SENSOR (See Fig. 7-4-11.)

(1) Remove the lead wire soldered to the REW sensor.

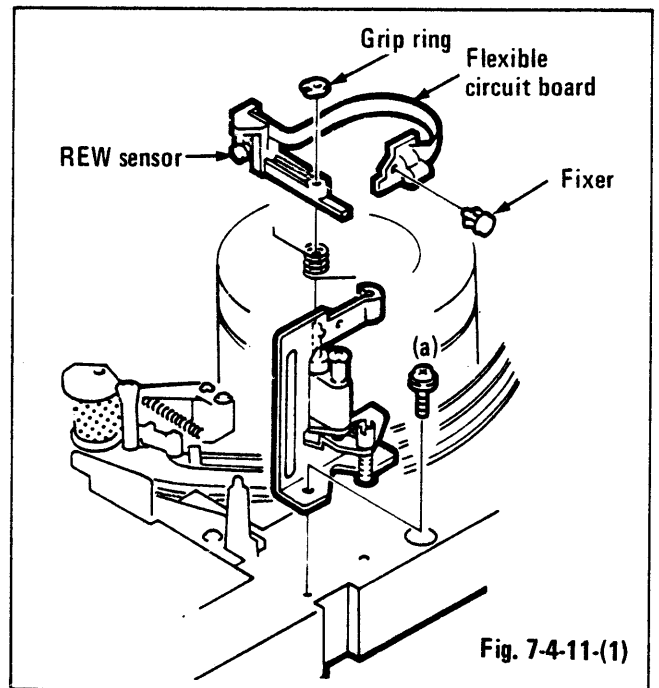
(2) Remove the screw (a), and then remove the REW sensor assembly.

(3) Remove the fixer securing the flexible circuit board, and then, after removing the grip ring, remove the REW sensor.

(Caution)

Do not to fold or twist the flexible circuit board.

(4) Install the new REW sensor by using the reverse order of the removal procedure.

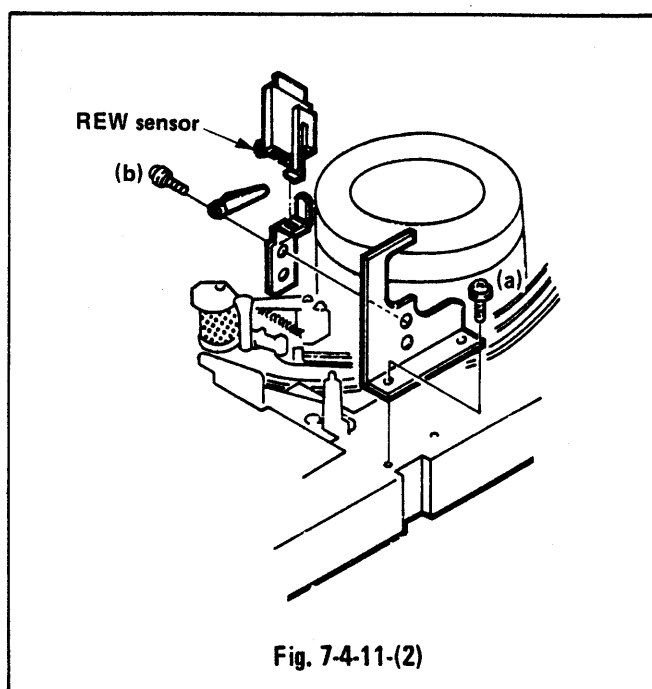


The rewind sensor in models produced in and after July, 1982 will be modified. A diagram of the modification is shown in Fig. 7-4-11-(2), and its removal is as follows:

(1) Remove the lead wire soldered to the REW sensor.

(2) Remove the screw (a), and then remove the REW sensor assembly.

(3) Remove the screw (b), and remove the capacitor soldered to the REW sensor.



12. CAPSTAN MOTOR (See Fig. 7-4-12.)

(1) Remove the bottom circuit board. (Refer to item "V. CIRCUIT BOARD DISASSEMBLY, 1. BOTTOM CIRCUIT BOARD".)

(2) Disconnect the capstan motor connector.

(Caution)

Be sure that the power is off [the power switch is in the "OFF" position] when connecting or disconnecting the connector.

(3) Remove the capstan motor bracket screws (a), and then remove the bracket.

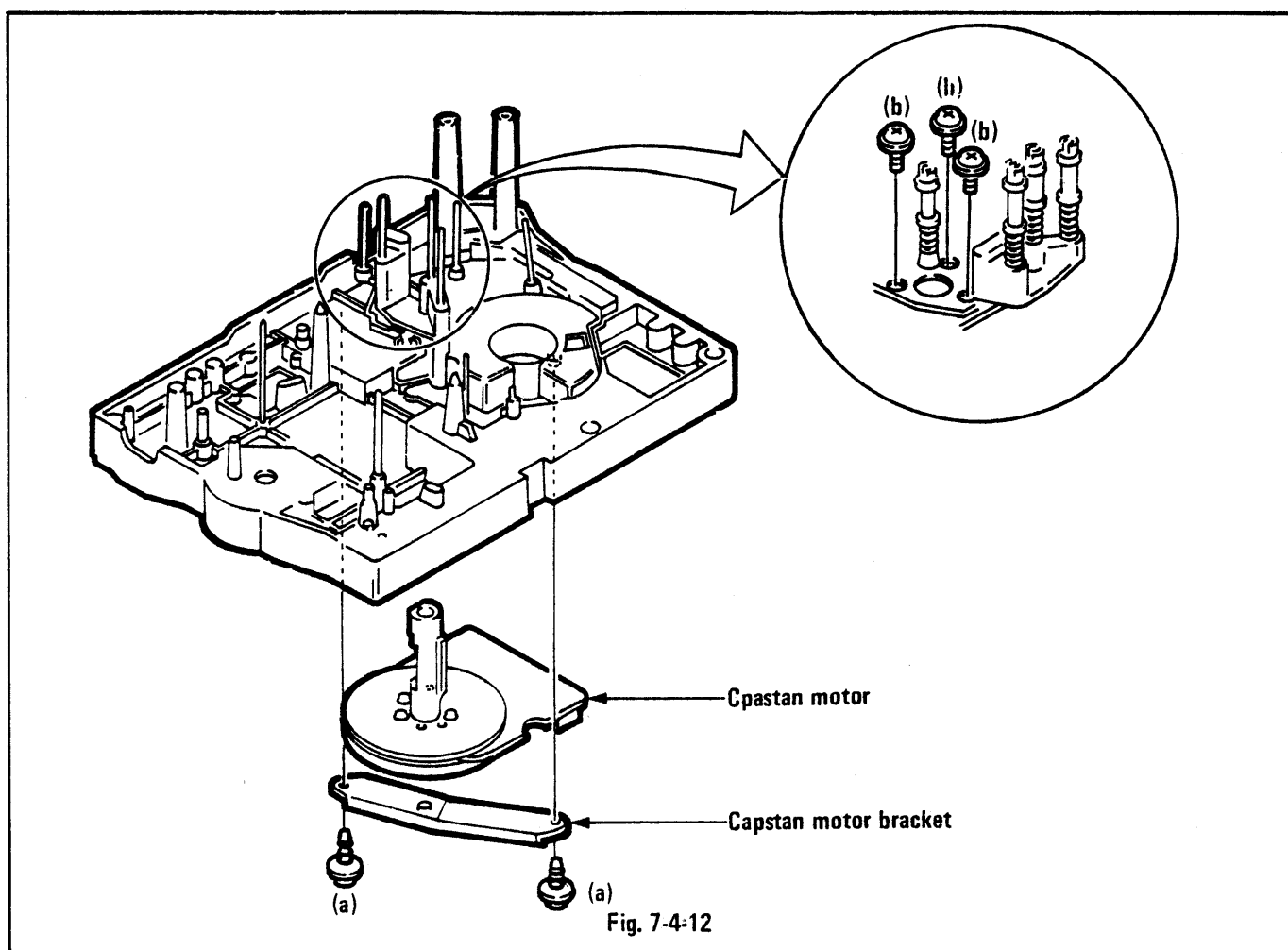
(4) Remove the screws (b) securing the capstan motor, and then remove the motor.

(5) Install the new capstan motor by using the reverse order of the removal procedure.

(6) Adjust the tape path.

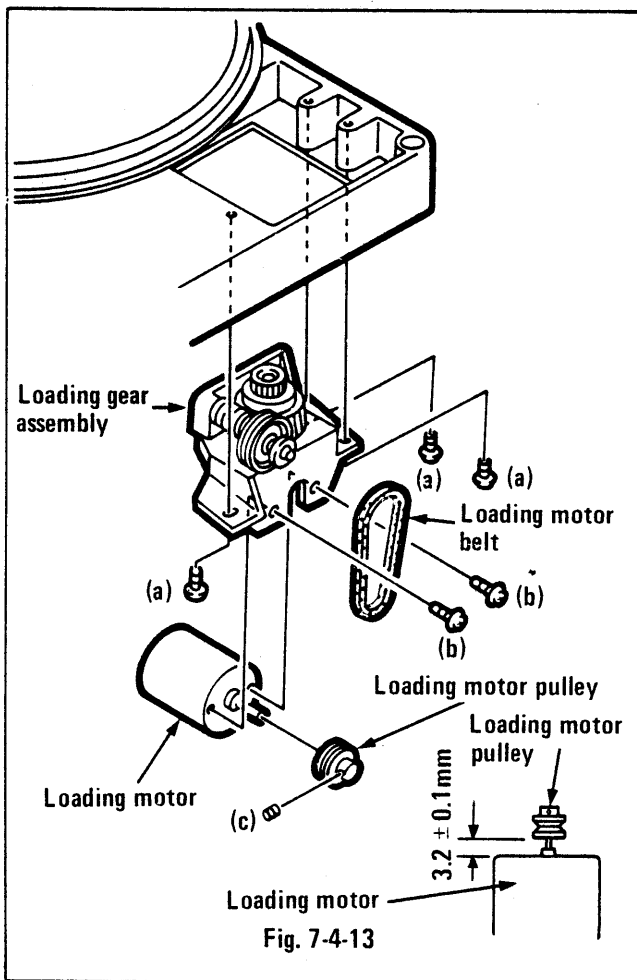
(Note)

Play the service alignment tape (VJ-0061) or a previously recorded tape; if the playback is normal, adjustment is not necessary.



13. LOADING MOTOR (See Fig. 7-4-13.)

- (1) Remove the bottom circuit board. (Refer to item "V. CIRCUIT BOARD DISASSEMBLY, 1. BOTTOM CIRCUIT BOARD".)
- (2) Remove the lead wire soldered to the loading motor.
- (3) Remove the loading motor bracket screws (a), and then remove the loading motor assembly.
- (4) Remove the loading belt.
- (5) Remove the screws (b) which secure the loading motor, and then remove the motor.
- (6) Loosen the set screw (c) which secures the loading motor pulley by using the Allen wrench (VJ-0108 ... M2.6), and then remove the pulley.
- (7) Mount the loading motor pulley to the new loading motor.



(Caution)

When mounting the loading motor pulley, be sure to adjust the height.

- (8) Install the loading motor by using the reverse order of the removal procedure.

14. LOADING RING (see Fig. 7-4-14.)

- (1) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)
- (2) Remove the supply reel base. (Refer to item "5. SUPPLY REEL BASE".)
- (3) Remove the ratchet brake.
- (4) Insert the curved tip A of the pressure spring attached to the pinch roller pressure lever into the hole B in the lever.
- (5) Cut the fixer securing the lead wire to the bracket head. Remove the solder from the E-head (full-erase head) terminal, and then remove the lead wire. Remove the screw securing the bracket head, and then remove the bracket head.
- (6) Remove the REW sensor assembly. (Refer to item "11. REW SENSOR".)

(Caution)

It is not necessary to remove the lead wire which is soldered to the REW sensor.

- (7) Disconnect the connectors, lead wires, etc.

* The video head lead wire connector (the 6-pin connector which is connected to circuit board VD-1)

* The various lead wire connectors for the audio/control head, the full-erase head, etc.

* The DEW sensor (Do not break the solder on the DEW sensor.)

- (8) Remove the bracket screws (a) of the loading ring support rollers, and then remove the bracket.

- (9) While pressing the back tension lever in the direction of arrow C and the mode select slide in the direction of arrow D, slide the loading ring upward and remove it.

(Caution)

When pressing the back tension lever, be careful not to press the back tension guide. In addition, be careful not to scratch the video head drum, the video heads, the audio/control head, the back tension guide, etc., and do not touch the loading guide or the pinch roller.

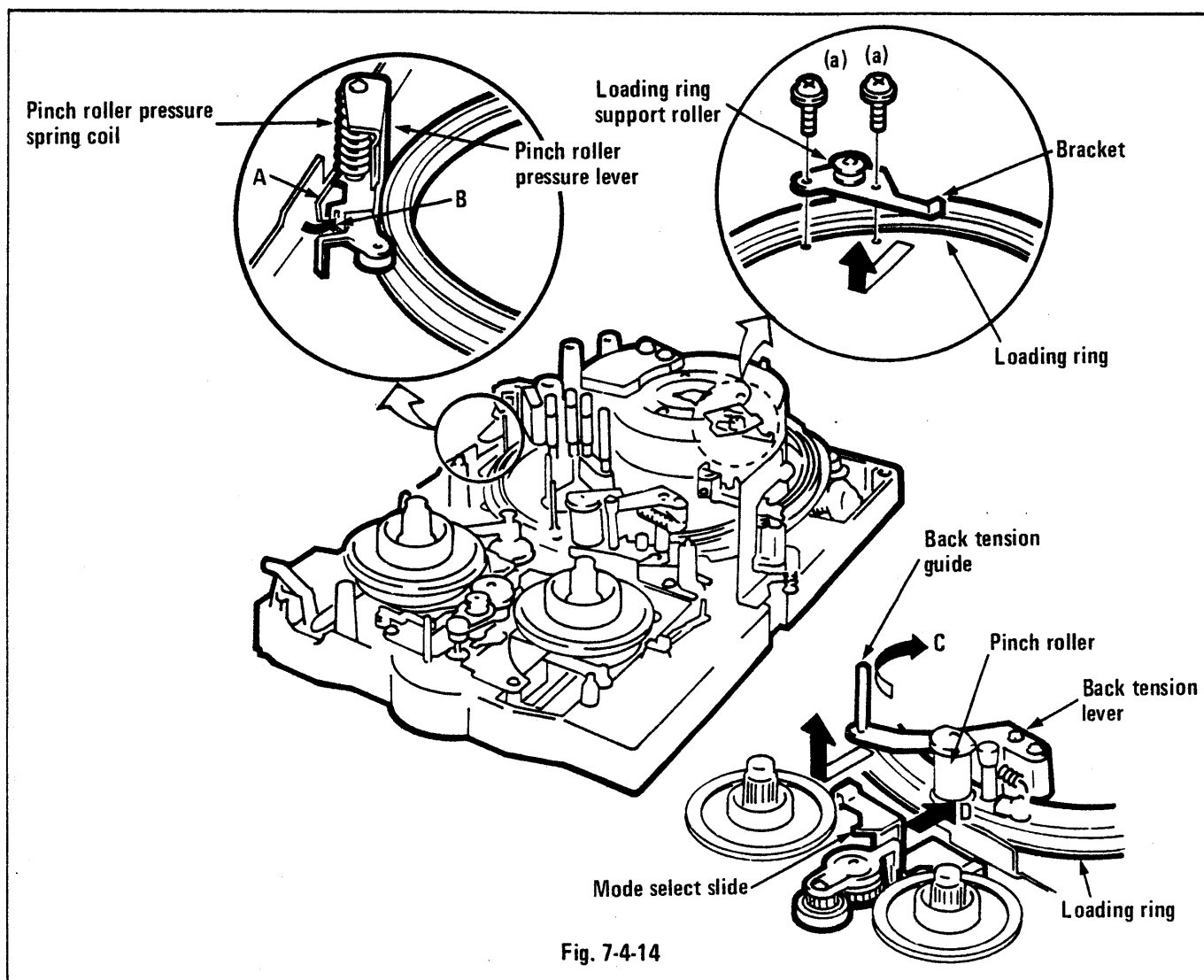


Fig. 7-4-14

[Loading ring installation] (See Figs. 7-4-15, 7-4-16)

(1) While pressing the back tension lever in the direction of arrow C and the mode select slide in the direction of arrow D, insert the loading ring, and fit it into the grooves of the two support rollers on the secured side.

(Caution)

When pressing the back tension lever, be careful not to press the back tension guide.

(2) Tighten the bracket screws (a) of the loading ring support rollers.

(Caution)

Be sure that the loading ring is set inside the grooves of the support rollers at all three places. Also, be sure that the loading gear and the loading ring gear are securely intermeshed.

(3) Set the loading ring to the condition at the completion of loading.

* Install the bracket head.

* Pass the fixer through the hole in the bracket head, and then bunch and secure the lead wire. Be sure that the lead wire does not hang down, and be careful not to put too much pressure on the bracket head.

* Solder the lead wire to the full-erase head terminal.

(4) Remove the curved tip A of the pinch roller pressure spring from the hole B in the pinch roller pressure lever, and connect it to the wall of the main chassis.

(5) Install the ratchet brake and other parts by reversing the order of the removal procedure.

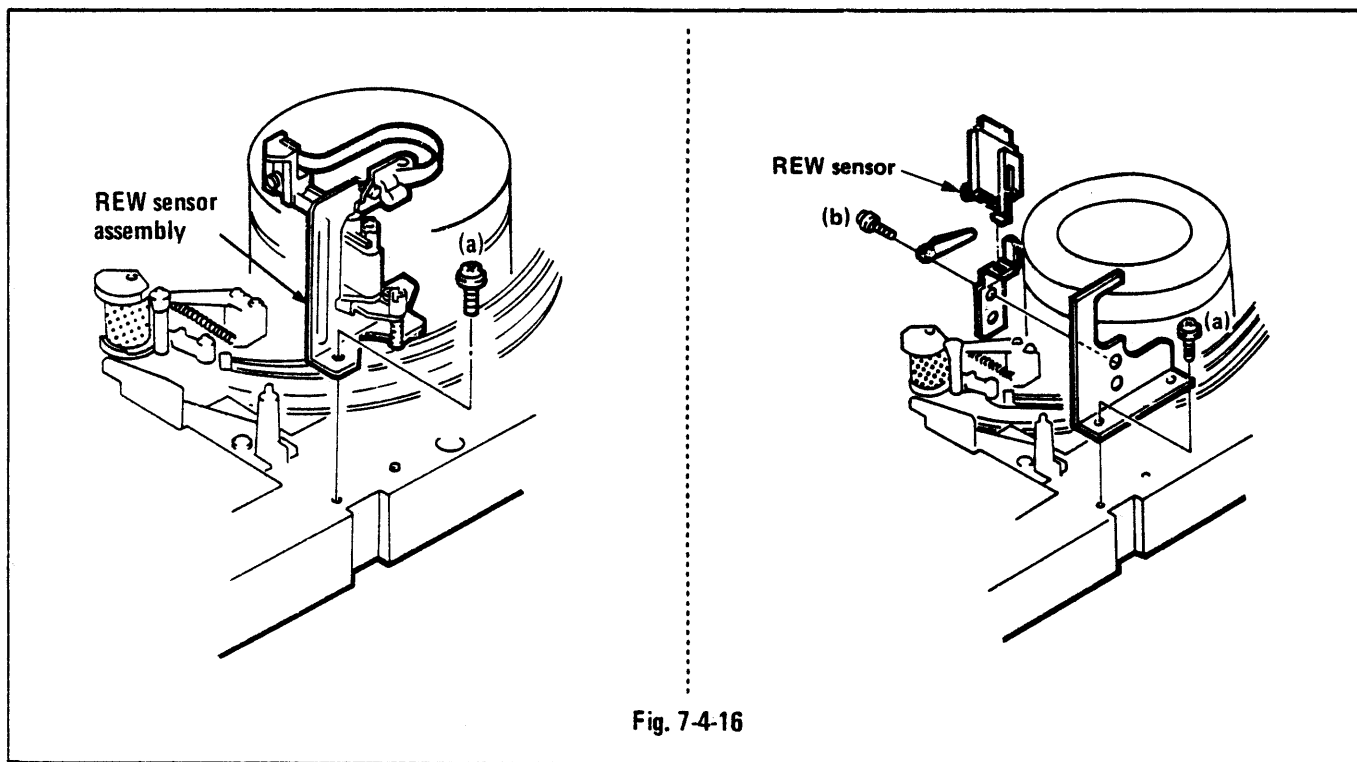
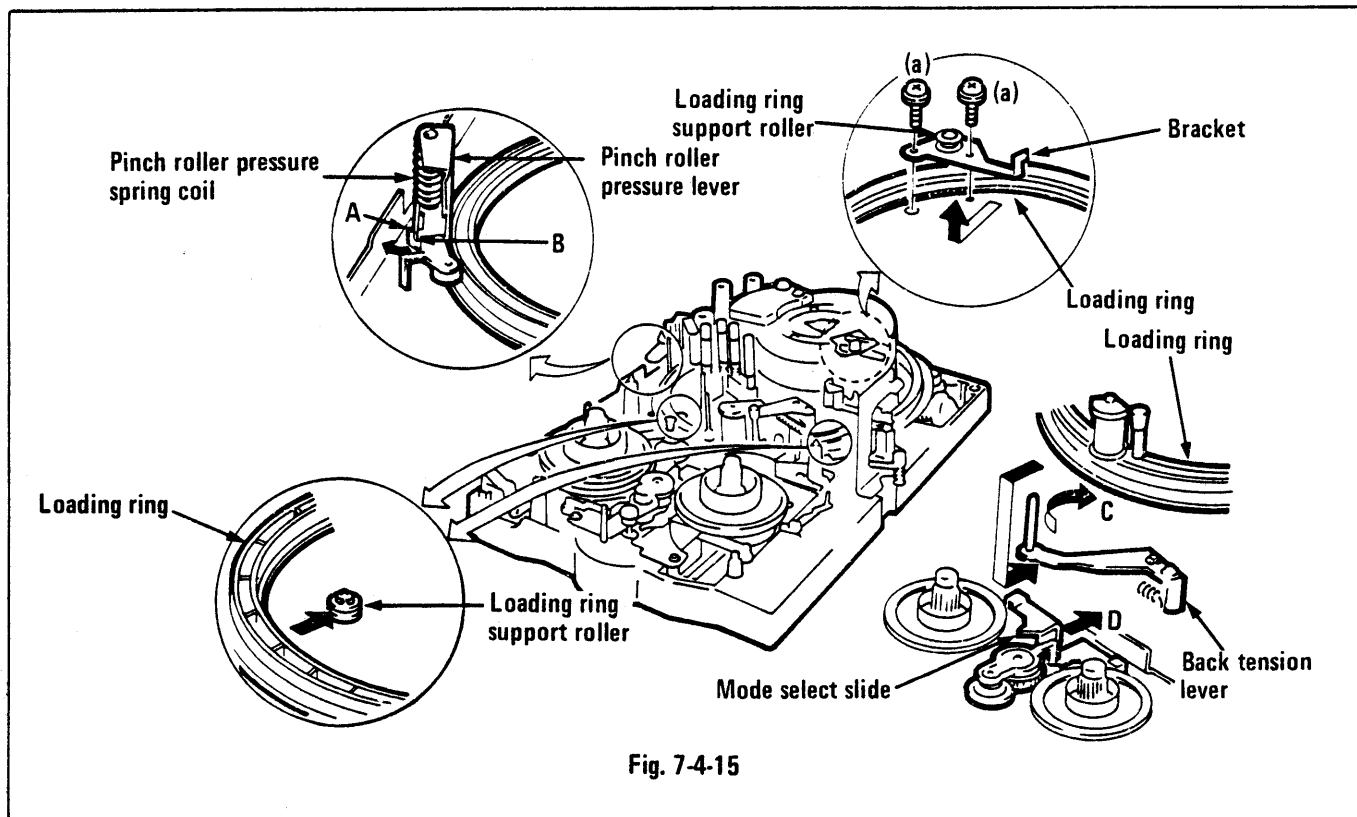
(Caution)

When the loading ring is in the condition of loading completion, install the REW sensor assembly as shown in Fig. 7-4-16.

(6) Play a previously recorded tape, and check that there is nothing wrong with the tape path.

(Caution)

When installing the loading ring, be careful not to scratch the video head drum, the video heads, the audio/control head, the back tension guide, etc.



15. REEL MOTOR (See Fig. 7-4-17.)

(1) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(2) Remove the bottom circuit board. (Refer to item "E. CIRCUIT BOARD DISASSEMBLY, 1. BOTTOM CIRCUIT BOARD".)

(3) Remove the lead wire which is soldered to the reel motor.

(4) Remove the reel motor belt.

(5) Remove the reel motor mounting screws (a), and then remove the motor.

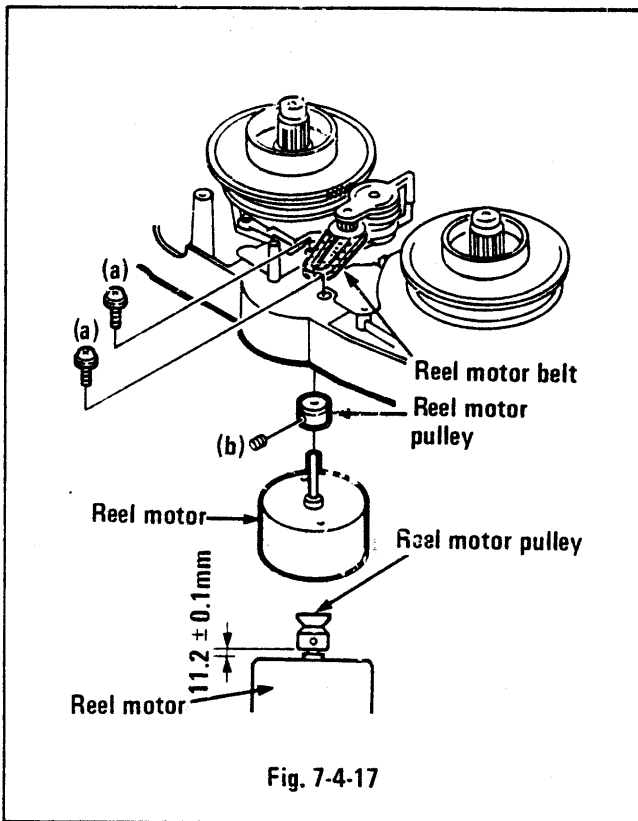
(6) Loosen the set screw (b) which secures the reel motor pulley by using the Allen wrench (VJ-0108....M2.6), and then remove the pulley.

(7) Mount the reel motor pulley onto the new motor.

(Caution)

When mounting the pulley, be sure to adjust the height.

(8) Install the reel motor by using the reverse order of the removal procedure.



16. VIDEO HEAD DISC (See Fig. 7-4-18.)

(1) Remove the solder of the PG lead wire (the lead wire connected to circuit board MC-4 which is part of video head drum A).

(2) Remove the DEW sensor.

(Caution)

Do not break the solder on the DEW sensor. Also note that the performance of the DEW sensor will be impaired if it is subjected to high temperatures for an extended period of time.

(3) Remove the screws (a), and the, while raising up video head drum A, loosen the M3 screws (b) by using a Phillips (cross-tip) screwdriver and remove video head drum A.

(4) Remove the screws (c) which secure the rotary transformer.

(5) Break the solder of rotary transformer lead wires (1), (2), (3), and (4), and then remove the transformer.

(Caution)

Make note of the soldered locations for each of the rotary transformer lead wires.

(6) Remove the screws (d) which secure the video head disc, and then replace the disc.

(Caution)

When installing the new video head disc, pay attention to the following points:

- * Tighten each of the screws (d) with an equal amount of torque (6 kg-cm). Do not overtighten them.

- * Do not remove the spacer underneath the video head disc. Install the new video head disc right onto the old spacer. (It is possible that there is no spacer.)

- * Solder the lead wires in their original positions, and shape them so that they follow along the video head disc and do not come in contact with drum A.

(7) Install the remaining parts by reversing the order of the removal procedure.

(Caution)

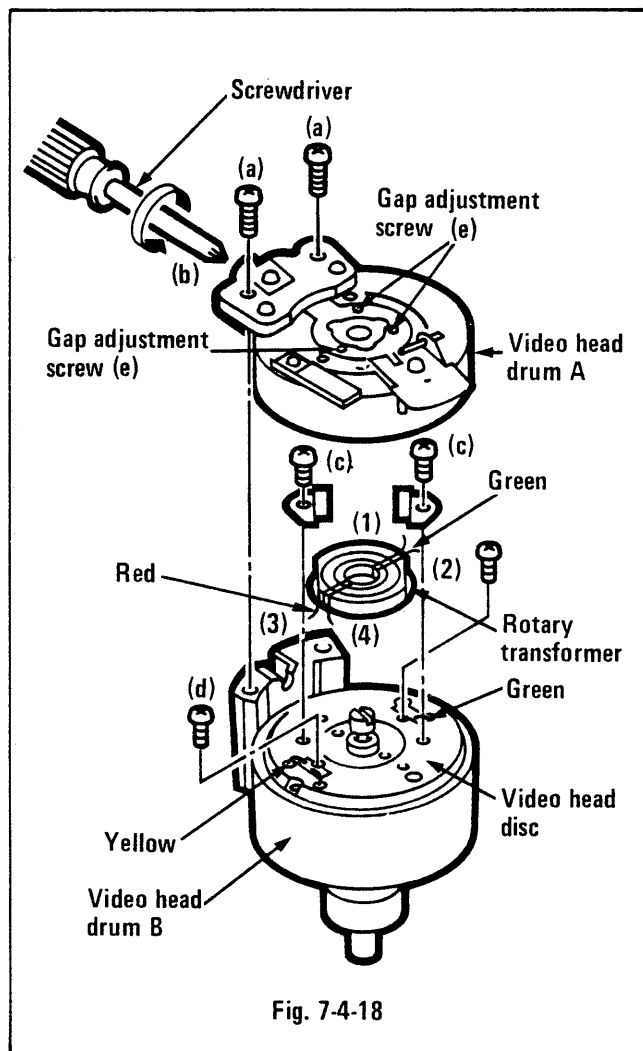
The M3 screws (b) determine the position of drum A. Tighten them with a torque of 1 kg or less.

(8) Play the service alignment tape (VJ-0093) or a previously recorded tape. If the image is not correct, and a correct image cannot be obtained by adjusting the tracking control, adjust the tape path. (Refer to item "F. TAPE PATH ADJUSTMENTS".)

(9) If a slipping noise is heard from the video head drum when the tape is played back, it is probably because the video head drum is not installed properly; loosen the screws (a) and the M3 screws (b) again and adjust drum A.

(Caution)

If the slipping noise is still heard after the adjustment is made, it indicates that the cause is a different thickness of the video head disc; turn the gap adjusting screws (e) $30^\circ \sim 40^\circ$ counter clockwise from the point at which the slipping noise is heard. (Tighten the gap adjusting screws (e) uniformly.)



E. ADJUSTMENTS

1. REEL BASE HEIGHT (See Fig. 7-5-1.)

If the reel base height is not correct, the tape inside the cassette will be unevenly wound. When this tape is used again, the unevenly wound tape will cause the tape tension to fluctuate, and the correct tape travel will be impossible to obtain.

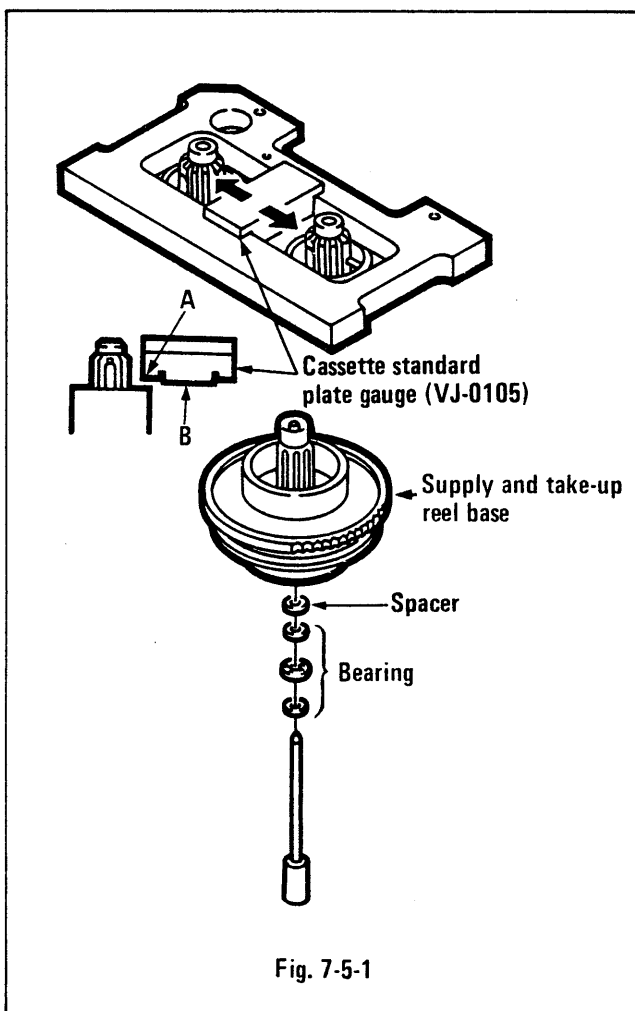
(1) Turn off the power. [Set the power switch to the "STAND BY" position.]

(2) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

(3) Insert the standard cassette plate (VJ-0105) and slide the gauge in the direction of the arrows.

(4) Confirm that, when the gauge stops, the reel bases are not in contact with surface A of the plate and are in contact with surface B.

(5) If a reel base is in contact with surface A, remove a spacer and check again.



(6) If a reel base is not in contact with surface B, add a spacer and check again.

(Note)

Adjust the reel base height by adding or removing spacers (0.13T, 0.25T, 0.5T) as appropriate so that the height meets the specifications. Use the same method for both the take-up reel base and the supply reel base.

2. BACK TENSION LEVER POSITION (See Fig. 7-5-2.)

The back tension must be applied uniformly to the tape so that the tape can travel smoothly with relation to the various heads and tape guides. If the back tension is too strong, it will cause the tape to stretch, and if it is too weak, the tape will separate from the heads and tape guides.

(1) Turn off the power. [Set the power switch to the "STAND BY" position.]

(2) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

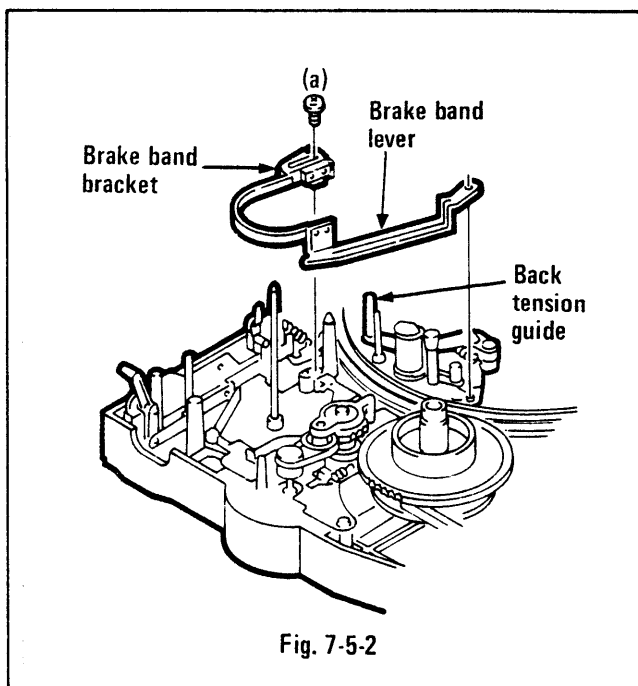
(3) Manually operate the loading ring to reach the condition of loading completion.

(4) Insert the back tension adjustment gauge (VJ-0120) and check the position of the back tension guide.

(5) If the position of the back tension guide is not correct, loosen the screw (a), move the brake band bracket, and adjust the position of the back tension guide.

(6) Tighten the screw (a) to secure the position of the brake band bracket.

(7) Move the loading ring to the condition of unloading completion, and install the cassette holder.



3. WINDING TORQUE (See Figs. 7-5-3 ~ 7-5-6.)

In the various modes of the VCR, the tape which leaves the supply (or take-up) reel is wound around the take-up (or supply) reel. If the winding torque is too weak, the tape will not be wound properly and will become slack. On the other hand, if the winding torque is too strong, an excessive amount of tension will be applied to the tape and cause the tape to stretch.

[FWD winding (recording, playback, forward search) torque] (See Fig. 7-5-3.)

(1) Turn off the power. [Set the power switch to the "STAND BY" position.]

(2) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)

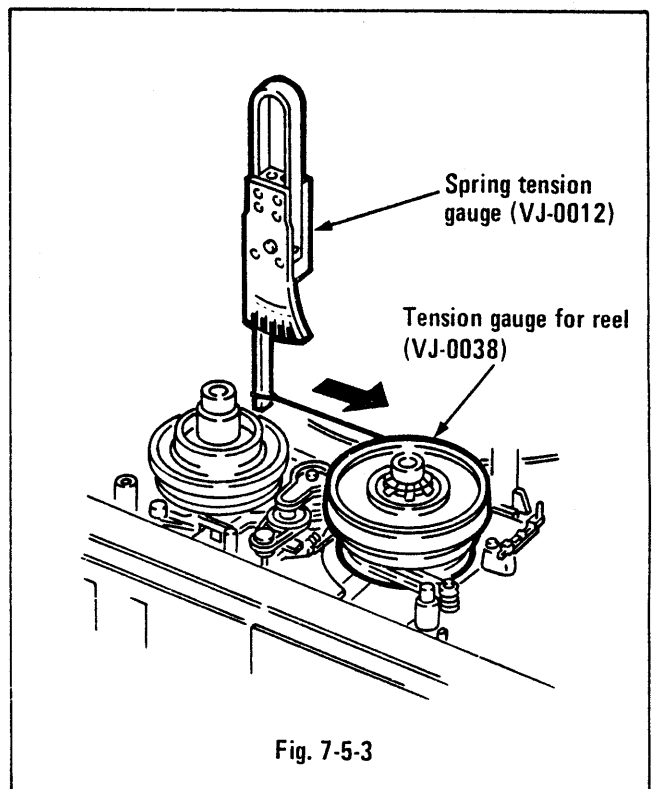
(3) Turn on the power. [Set the power switch to the "ON" position.]

(4) Mount the reel tension gauge (VJ-0038) on the take-up reel base, and then connect the string to the end of the spring tension gauge (VJ-0012).

(5) Press the PLAY button and measure the torque. The winding torque should be between 30 g and 53 g.

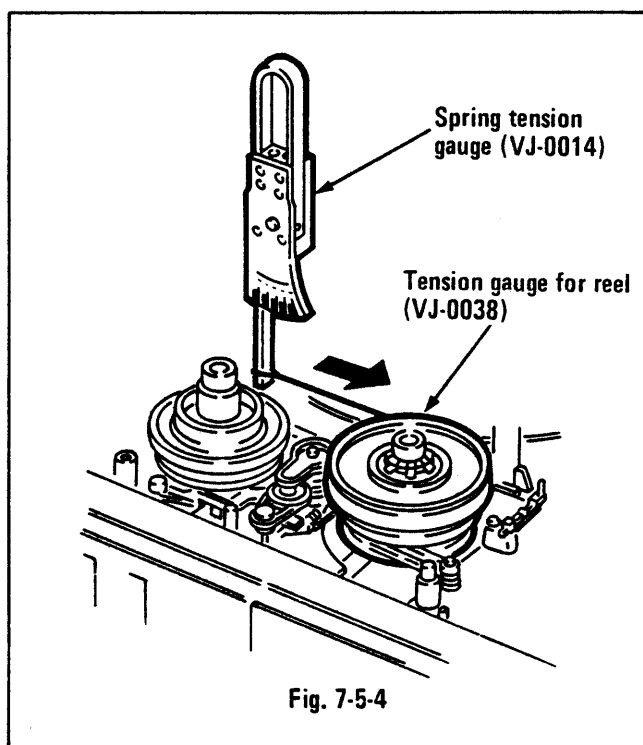
(6) If the measured value is not within the specified value range, replace the take-up reel base.

(7) Install the cassette holder.



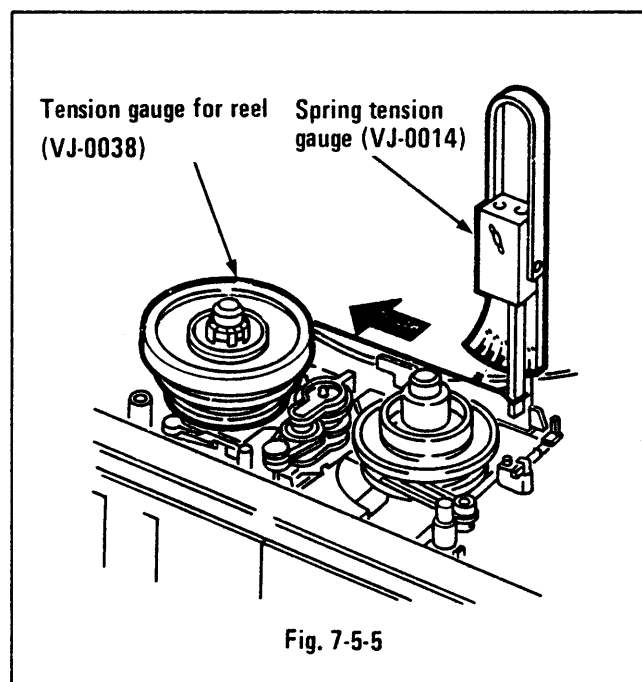
[F FWD winding torque] (See Fig. 7-5-4.)

- (1) Turn off the power. [Set the power switch to the "STAND BY" position.]
- (2) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)
- (3) Turn on the power. [Set the power switch to the "ON" position.]
- (4) Mount the reel tension gauge (VJ-0038) on the take-up reel, and then connect the string to the end of the spring tension gauge (VJ-0014).
- (5) Press the F FWD button, and measure the torque. The winding torque should be 165 g or more.
- (6) If the measured value is less than the specified value, check for a problem with the reel motor belt, and replace the belt if necessary.
- (7) Install the cassette holder.



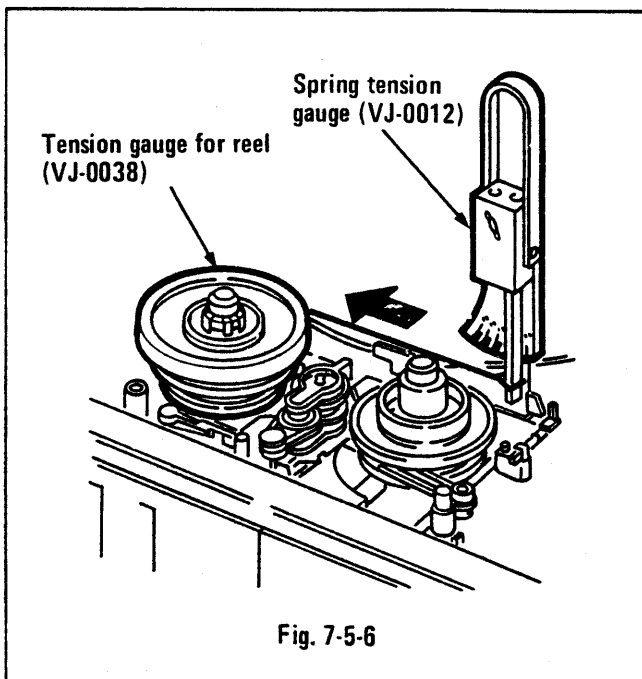
[REW winding torque] (See Fig. 7-5-5.)

- (1) Turn off the power. [Set the power switch to the "STAND BY" position.]
- (2) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)
- (3) Turn on the power. [Set the power switch to the "ON" position.]
- (4) Mount the reel tension gauge (VJ-0038) on the supply reel, and then connect the string to the tip of the spring tension gauge (VJ-0014).
- (5) Press the REW button, and measure the torque. The winding torque should be 165 g or more.
- (6) If the measured value is less than the specified value, check for a problem with the reel motor belt, and replace the belt if necessary.
- (7) Install the cassette holder.



[R-SEARCH winding torque] (See Fig. 7-5-6.)

- (1) Turn off the power. [Set the power switch to the "STAND BY" position.]
- (2) Remove the cassette holder. (Refer to item "B. PREPARATIONS FOR ADJUSTMENT".)
- (3) Turn on the power. [Set the power switch to the "ON" position.]
- (4) Mount the reel tension gauge (VJ-0038) on the supply reel, and then connect the string to the end of the spring tension gauge (VJ-0012).
- (5) Press the R-SEARCH button, and measure the torque. The winding torque should be between 58 g and 74 g.
- (6) If the measured value is not within the specified value range, replace the supply reel base.
- (7) Install the cassette holder.



F. TAPE PATH ADJUSTMENTS

Each of the heads and tape guides has been adjusted to the precisely correct position and height. These parts have a very strong influence on tape travel, and should normally not be touched. If the video head drum, the full-erase head, the audio/control head, etc., have been replaced, playback the service alignment tape (VJ-0061) or a previously recorded tape, and check the image. Only if there are problems with the image that cannot be corrected by adjusting the tracking control should tape path adjustments be made. Also note that tape path adjustments should be made without removing the cassette holder.

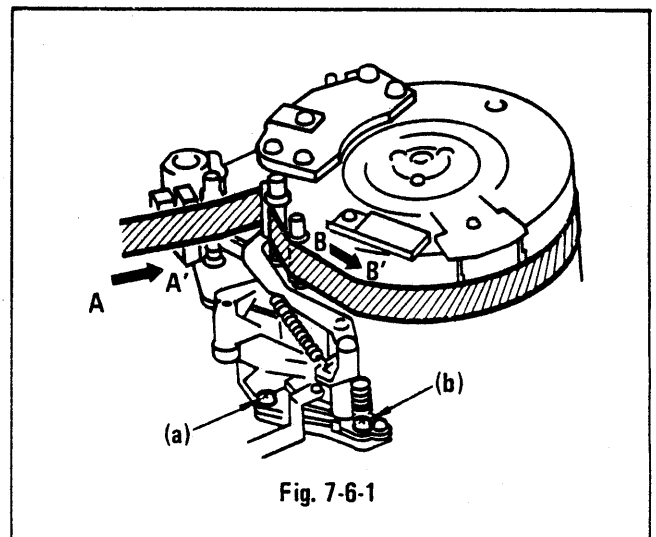
1. BACK TENSION GUIDE VERTICAL POSITION (See Fig. 7-6-1.)

(1) Play a tape on which the edges are not stretched, and check that there is no looseness in both the upper and lower edges of the tape in the area of the back tension guide.

(2) If there is any looseness, adjust the screws (a), (b) so that the tension is applied evenly to the tape.

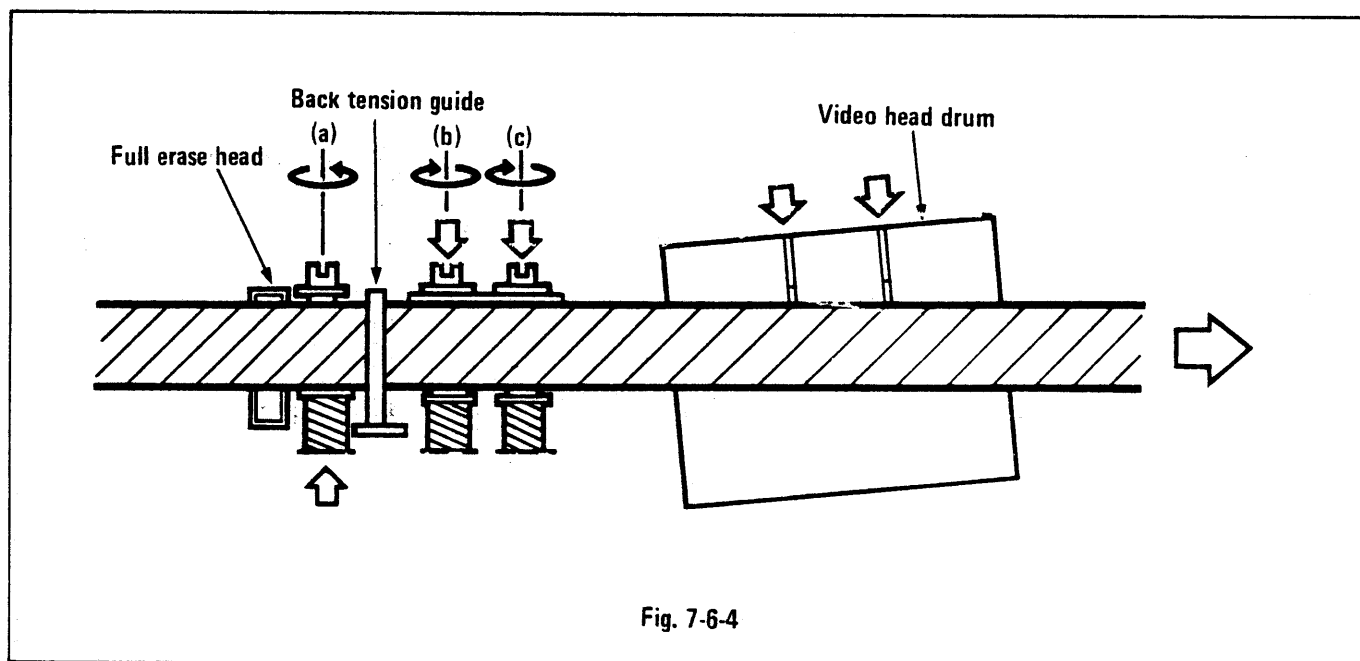
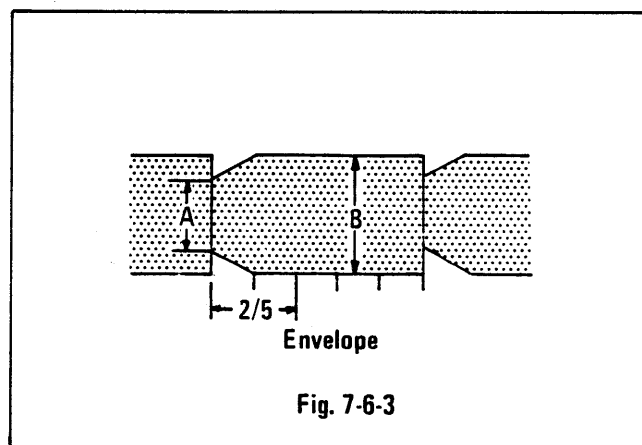
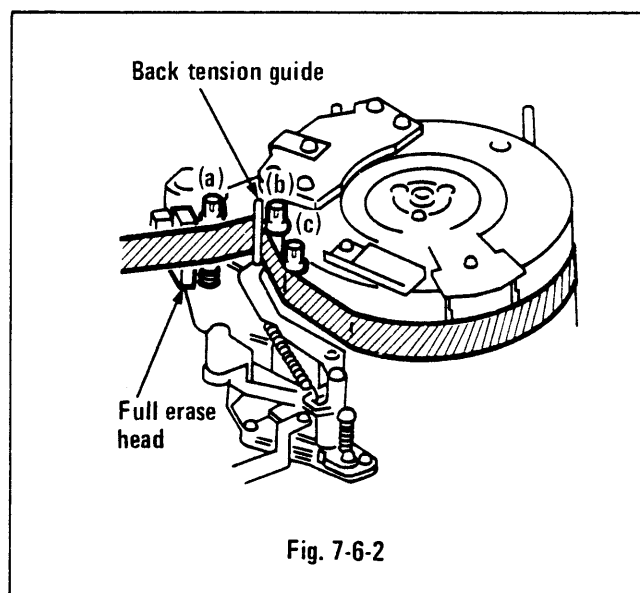
(Note)

Adjustment for the tape entering the back tension guide (direction A → A') is made by using screw (a), and that for the tape leaving the back tension guide (direction B → B') by using screw (b).



2. FULL-ERASE HEAD TAPE GUIDES (See Figs. 7-6-2 ~ 7-6-4.)

- (1) Connect an oscilloscope to the video output terminal (the check terminal of circuit board VD-1, pin (4) of S1007), and then playback the service alignment tape (VJ-0061).
- (2) Check the tape travel in the area of the back tension guide. If there is any looseness in either the upper or lower edges of the tape, adjust tape guides (a), (b), and (c) so that the guide flanges are not in contact. (See Fig. 7-6-2.)
- (3) While checking the waveform (envelope), adjust tape guide (a) so that the lower flange of the guide supports the lower edge of the tape. Next, adjust so that the size of amplitude A of the waveform is approximately -6dB ($1/2$ the size) in relation to the size of amplitude B of the waveform at a position approximately $2/5$ from the head switching point. (See Fig. 7-6-3.)
- (4) While checking with the inspection mirror (VJ-0015), adjust tape guides (b) and (c) so that the upper flanges of the guides do not cause any creases in the tape, lowering both guide (b) and guide (c) equally in order to maximize the size of amplitude A. (See Fig. 7-6-4.)



3. AUDIO/CONTROL HEAD TAPE GUIDES (See Figs. 7-6-5, 7-6-6.)

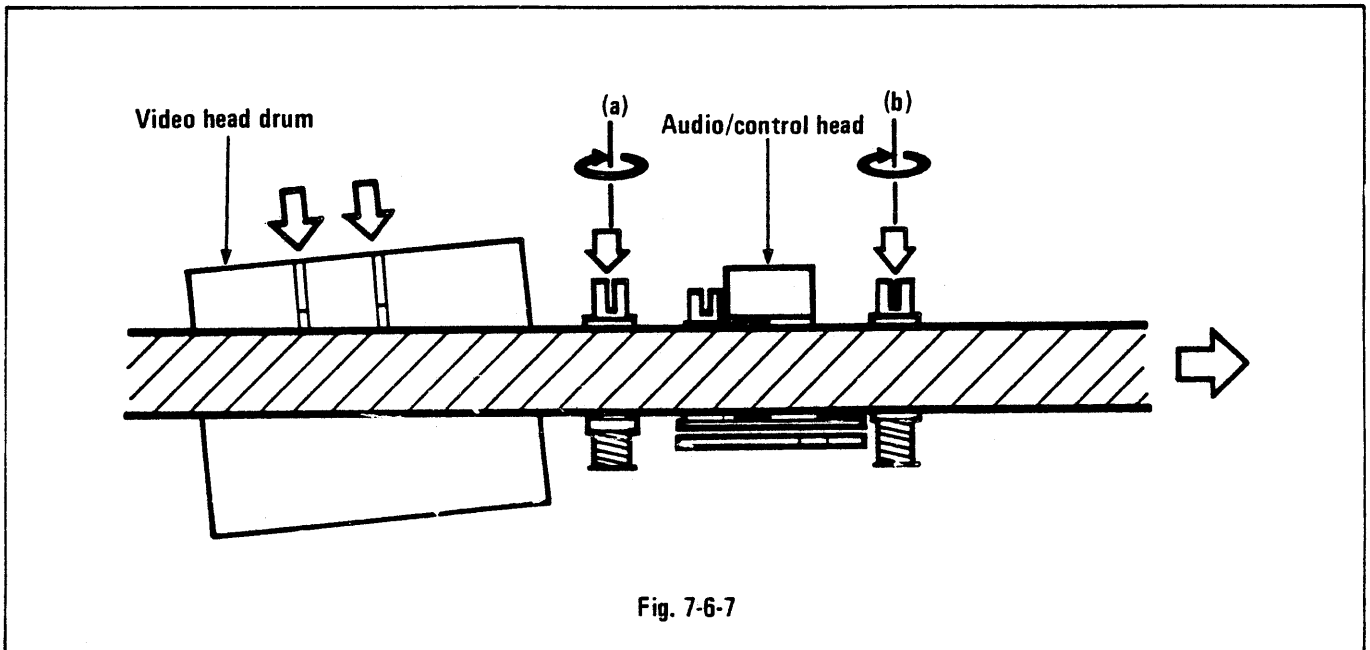
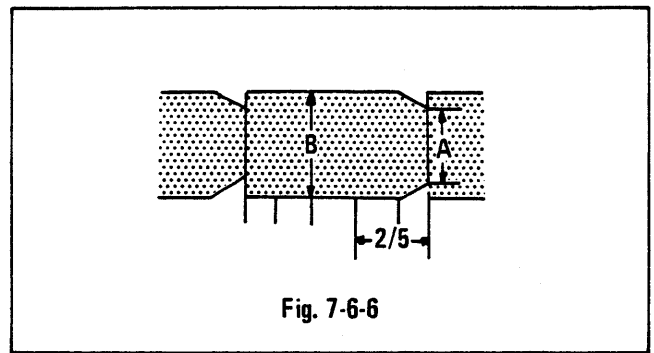
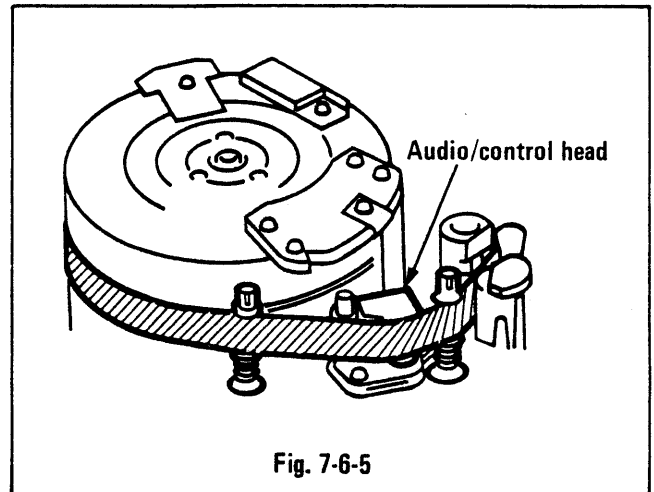
(1) Connect an oscilloscope to the video output terminal (the check terminal of circuit board VD-1, pin (4) of S1007), and playback the service alignment tape (VJ-0061).

(2) Check the tape travel in the area of the audio/control head. If there is any looseness in either the upper or lower edges of the tape, adjust tape guides (a) and (b) so that the guide flanges are not in contact. (See Fig. 7-6-5.)

(3) While checking the waveform (envelope), adjust tape guide (b) so that the upper flange of the guide the upper edge of the tape. Next, adjust so that the size of amplitude A of the waveform is approximately $-3\text{dB} \sim -6\text{dB}$ ($2/3 \sim 1/2$ the size) in relation to the size of amplitude B of the waveform at a position approximately $2/5$ from the head switching point. (See Fig. 7-6-6.)

(4) While checking with the inspection mirror (VJ-0015), adjust tape guide (a) so that the upper flange of the guide does not cause, any creases in the tape, lowering guide (a) so that the size of amplitude A is maximized. (See Fig. 7-6-6.)

(5) If either the upper or lower edge of the tape is not in contact with the audio/control lead and the tape guides and there is a unbalance between the top and the bottom, it is probably caused by the audio/control head slanting either forward or backward. (Refer to item "4. AUDIO/CONTROL HEAD).



4. AUDIO/CONTROL HEAD (See Fig. 7-6-8.)

Connect an oscilloscope to the audio output terminal (the check terminal of circuit board VD-1, pin (6) of S1008), and then playback the service alignment tape (VJ-0061).

[Slanting forward or backward]

Check the tape travel. If either the upper or lower edge of the tape is not in contact with the audio/control head and the tape guides, and there is an unbalance between the top and the bottom, adjust the Allen screw (a) by using the Allen wrench (VJ-0022). When the Allen screw (a) is turned to the right (clockwise), the audio/control head will slant forward, and when the Allen screw (a) is turned to the left (counter clockwise), the audio/control head will slant backward.

[Head height]

Adjust nut (b) with a flat-tipped screwdriver so that the audio output is maximized.

[Azimuth (head left-right angle)]

Adjust screw (c) with a Phillips (cross-tipped) screwdriver so that the audio output is maximized.

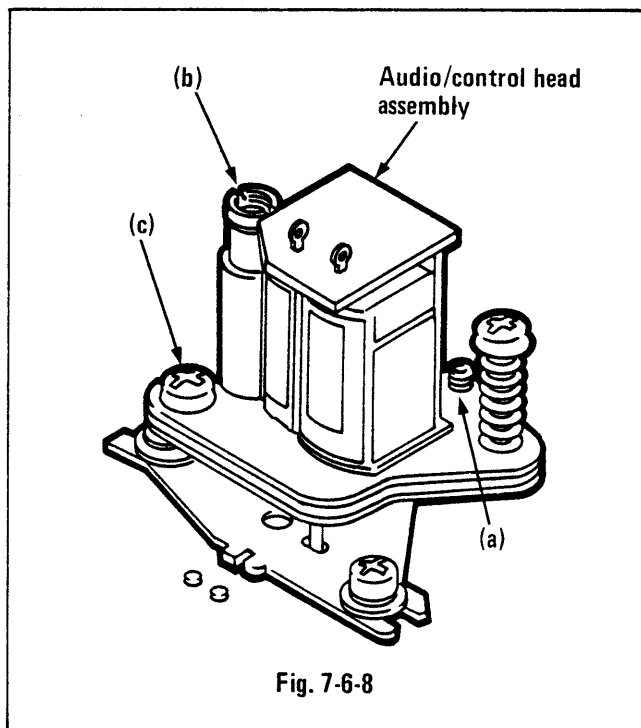


Fig. 7-6-8

5. TRACKING (See Fig. 7-6-9.)

(1) Connect an oscilloscope to the video output terminal (the check terminal of circuit board VD-1, pin (4) of S1007), and playback the service alignment tape (VJ-0061).

(2) Loosen screws (a) and (b) approximately a 45° (1/4) turn only, insert a flat-tipped screwdriver into the notch (c), and turn left and right to adjust so that the waveform (envelope) observed on the oscilloscope is maximized.

(Caution)

If screws (a) and (b) are loosened too much and the adjustment is made, the proper adjustment might be lost when the screws are retightened.

(3) After making the adjustment, retighten screws (a) and (b).

(4) Next, playback a tape which was previously recorded and confirm that the envelope is maximized when the tracking control is at the center position.

(Caution)

If the envelope appears to be minimized when the tracking control is at the center position, readjust the tracking control and set it to a different envelope maximum point.

(5) Turn the tracking control to the right and left so that the waveform (envelope) which appears on the oscilloscope changes fairly evenly.

(6) Record and playback a television broadcast, and confirm that there are no problems with the image on the screen.

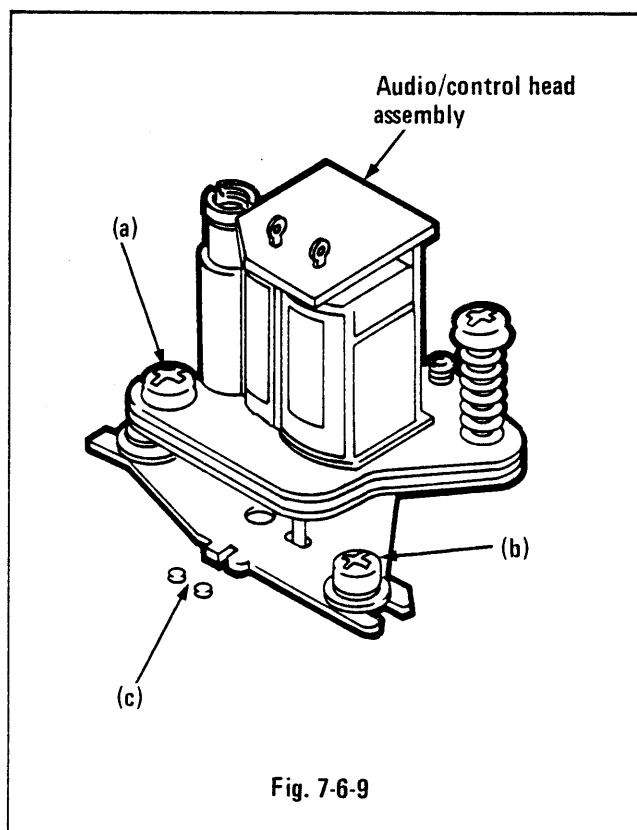
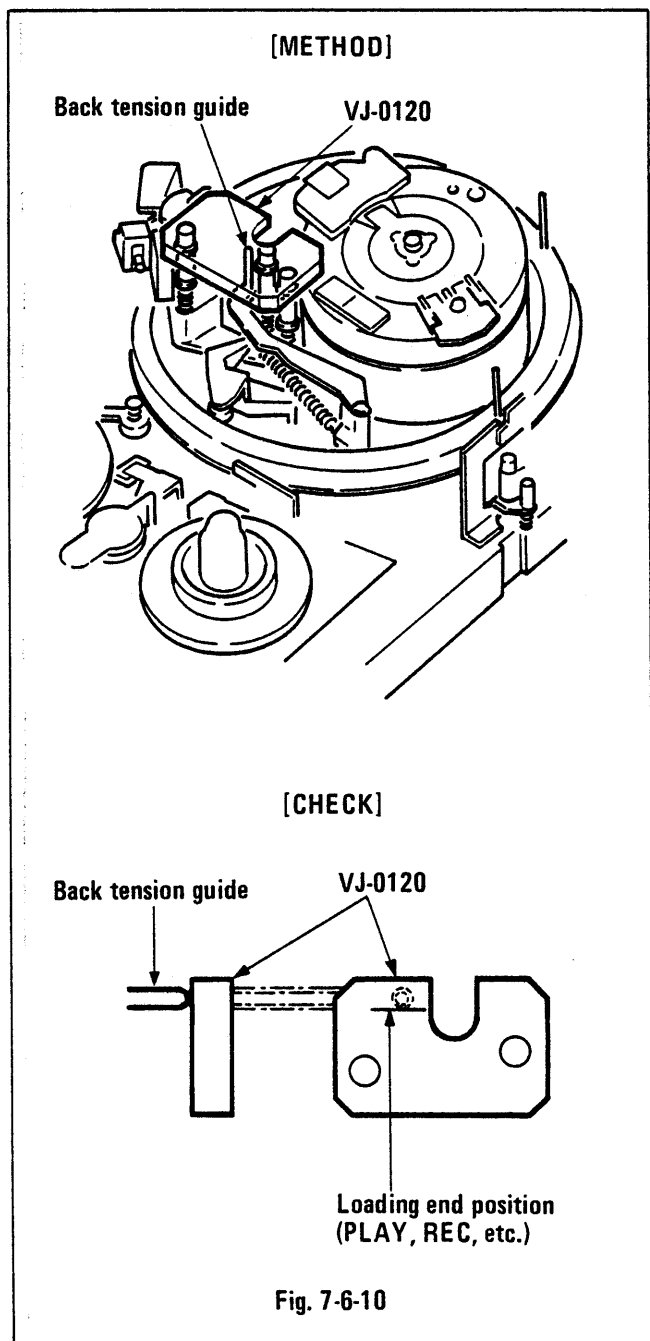


Fig. 7-6-9

G. USING METHOD OF MECHANISM JIG

[Adjustment gauge of back tension guide ... VJ-0120]



[Checker adjustment gauge of back tension guide ... VJ-0121]

